TABLE XIV

ILLINOIS DEPARTMENT OF PUBLIC HEALTH

Divisions of Radiological Health, Nuclear Safety, and Laboratory Support (combined) Workforce Projections to 1982 (est.)

Positions	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Physicist	8	8	8	8	8	9	n/a	n/a
Chemist	2	2	2	2	3	3	n/a	n/a
Engineer	3	3	3	3	3	4	n/a	n/a
Technician	15	15	18	19	19	19	n/a	n/a
Other	4	4	4	5	5	5	n/a	n/a
TOTAL	32	32	35	37	38	40		

Currently there are three vacancies in the Division of Radiological Health due to field technicians leaving the public sector for better salaries. Table XIV reflects the assumption that these authorized positions, now subject to the job freeze, will be refilled by the end of 1978. The increases indicated for 1979, 1980, and 1981 represent increases in staffing of the Division of Nuclear Safety and laboratory services which will be necessitated by Illinois becoming an NRC state. Some increases in workload due to a new nuclear power plant reactor in operation may occur as early as 1979. However, the other reactors are currently scheduled for start up in 1980, 1981, and 1982. It is likely that subsequent workload increase for the Division of Nuclear Safety's monitoring activities will not require additional personnel until 1982. Slippage in the construction and start up of the plants could set the need for increased IDPH workforce back even more.

The radiation protection workforce in the private sector is likely to increase dramatically. The number involved in X-ray calibration and

consulting may increase slightly. The major changes will occur in the facilities producing nuclear power, those engaged in aspects of the nuclear fuel cycle, and those engaged in research. The current private sector radiation workforce of 120-150 will increase as much as 80 persons as the nuclear power stations now under construction prepare to come on line.

The Morris facility may expand but the likelihood is tempered by present zoning regulations. Fermilab is adding personnel as it expands its research activities. Argonne National Laboratory expects an overall growth of about 5%, some of which will be in radiation protection.

The private sector radiation protection workforce in nuclear power stations, fuel cycle facilities and research facilities could reach 225-250 persons by the end of 1981 or 1982.

It should be noted that many of those presently employed in radiation protection in the private sector were recruited from those trained in the U.S. Navy's nuclear program. It is not known if this recruitment will continue as in the past. The Navy has been critical of recruitment procedures which have a negative effect upon re-enlistment.

D. Training and Certification

Training activities in radiation protection are as widespread and varied as might be expected in such a multifaceted field.

The IDPH staff have participated in numerous training sessions across the nation. They routinely engage in internal cross-training. Individual areas of expertise are shared. Much of the in-house training is part of a monthly program conducted for the 13 IDPH employees who comprise the Illinois Radiological Assistance Team (ILLIRAT). ILLIRAT members, on 24-hour call, respond to radiological emergencies in addition to their regular duties.

The team offers training for other state agencies and user groups upon request. Training sessions are most often attended by local rescue squads and hospital personnel.

IDPH has participated in special training programs for State policemen in which included radiation detection and protection. Under an agreement with the federal government, equipment has been purchased and mounted in State Police cruisers for monitoring radioactive materials with sodium iodide detectors.

In the past, IAEC has co-sponsored a series of seminars on peacetime nuclear incidents with the Illinois Civil Defence Agency. IAEC also worked with that agency in Illinois State Police training. A three-part seminar, "Atomic Energy in Illinois: Benefits and Risks", developed by Sangamon State University, was presented to the Illinois State Legislature by IAEC in 1974. The IAEC has not engaged in this type of educational activity recently.

The Emergency Services and Disaster Agency (into which the Civil Defense Agency was merged) regularly includes radiation protection as a part of its training for staff and for thousands of volunteers throughout the state.

Persons receive training in radiation protection in the universities, community colleges and public and private technical training schools.

The Westinghouse Electric Corporation, Nuclear Service Division (described more fully in ENERGY), provides training in radiation protection for nuclear power plant employees. Some training in radiation protection is conducted at the Westinghouse Nuclear Training Center in Zion, Illinois. The full radiation protection program is offered at the Westinghouse training facility in Pittsburgh, Pennsylvania.

E. Career Potential

Career opportunities in radiation protection will continue to develop in Illinois throughout the 1980's. Total employee increase due to the four nuclear power plants under construction (the last scheduled for completion in 1982) is estimated at 1,400 persons. Of these at least 80 will be in radiation protection positions.

Expansion at the other facilities is expected to necessitate approximately 20 to 30 more people. Thus, expansion in the private sector is expected to add a minimum of 100 persons specifically responsible for radiation protection between 1977 and the early 1980's. These positions include chemists and health physicists with at least four-year degrees, technicians with two-year degrees, and persons without degrees but who have received extensive specific training.

F. Conclusion

Nuclear energy, radiation-based medical procedures, and nuclear research are expanding enterprises in Illinois. These, the nuclear fuel cycle facilities, and the increasing volume of radioactive materials being transported throughout the state, combine to make radiation protection careers a significant and growing proportion of the workforce.

Programs for training and retraining radiation personnel will need expansion as a consequence. Programs in radiation protection must meet the demand for qualified people, relay developments in the field, and educate the public at large.

As the nuclear industry continues to grow in Illinois, the demand for well-educated and well-trained personnel in the public and private sector will increase. Career opportunities appear quite good in the field.

VI. SOLID WASTE

A. Introduction

The Illinois Environmental Protection Agency's Division of Land Pollution Control activities regarding solid waste disposal have not changed since the original Illinois report, written in 1974. There are fewer solid waste disposal sites; more are larger operations which employ several people. The Sheffield low-level radioactive waste disposal site supervised by the Illinois Department of Public Health, not discussed in the earlier report, is included below.

Illinois has 465 solid waste disposal sites. Of these, 134 are listed as illegal due to one or more factors which disqualify the site from eligibility for a permit for operation as a sanitary landfill site. The bulk of these are relatively small private sites, many of which may not now be in use. Publicly owned and/or operated sites (31 percent of the total sites) account for 20 percent of the illegal sites.

The closing of promiscuous dumps (those in greatest violation of Illinois Environmental Protection Agency standards) has, with few exceptions, been dealt with and is no longer a major emphasis of the agency's activity.

Slightly more than half the sites are defined as municipal or general; the others are demolition sites. The former generally handle wastes which will putrify; the latter deal with materials such as bricks, glass, or metals which are either recovered, recycled, or converted.

The IEPA estimates that more than sixty percent of the solid waste handled in Illinois is generated in the six-county area including and surrounding Chicago. Approximately forty firms (many operate several sites)

serve this area and employ up to fifty percent (4,500-5,000) of the statewide solid waste labor force.

The safe disposal of hazardous materials and liquid wastes is now considered of primary concern to IEPA and the relatively few firms who handle them. The volume of these materials is rising and a fatal accident has occurred at a landfill in Illinois involving liquid wastes.

Illinois is expected to receive about $1,250,000 in federal funds for assistance in dealing with hazardous materials disposal under a provision of the federal Resource Conservation and Recovery Act of 1976 (RCRA) which will allocate monies for that purpose based upon population.

Resource recovery activities in Illinois are increasing, but very slowly. Ferrous metals are the major category of materials recovered. High quality paper recycling is done on a small scale; some sulfur recovery for the burning of high-sulfur coal is done in the Wood River area. Some sources feel that only after RCRA is implemented, with the effect of increasing the costs of solid waste disposal, will resource recovery become economically advantageous. RCRA will not be implemented for two years; full impact will of course require more time.

RCRA is expected to effect an increase in numbers of people involved in legal, planning, and engineering aspects of solid waste management and cause an increase in the size of site crews. Regional planning efforts are expected to result in sites which are larger in area and fewer in number.

The increase which has occurred in the resource recovery workforce over the past year has, for the most part, been due to the completion of the City of Chicago/Commonwealth Edison Refuse Derived Fuel (RDF) project which is now on line. The power generation plant operates on fuel consisting of ninety percent coal and ten percent solid waste. It burns 1,000 tons of solid waste

per day. A similar, but smaller volume plant (Dallman Power Generation Station #3) to serve Springfield is about two years from start up. It will burn 250 tons of solid waste per day.

Increasing awareness by the public of solid waste problems is evidenced by support for a bill now in committee in the Illinois legislature. It would require a minimum of a $.05 deposit on beverage containers and is similar to measures adopted by Oregon and Michigan. Chances of passage are not known at this time; the bill is heavily opposed by segments of the beverage industry. A similar ordinance is being considered for the city of Champaign.

B. Workforce Profile

Information for this section was obtained during interviews with landfill owner/operators and IEPA personnel. Mr. George Edema, Browning-Ferris Industries, and Mr. Bert Fowler, Waste Management of Illinois, were particularly helpful. Discussions with Mr. Thomas E. Cavanagh, Jr., manager of the Permits Division of Land/Noise Pollution Control, IEPA, were invaluable.

The Division of Land Pollution Control is charged to:

1) promote the conservation of natural resources;

2) prevent the pollution of misuse of land;

3) minimize environmental damage by reducing the difficulty of disposal of wastes;

4) encourage and effect the recycling and re-use of waste materials;

5) upgrade waste collection and disposal practices.

Table XV presents the current (1976) public sector workforce in solid waste pollution control.

TABLE XV

IEPA DIVISION OF LAND POLLUTION CONTROL
Current (1976) Staffing Level

Position	1976
Engineer	7
Chemist	1
Geologist	2
Sanitarian	12
Attorney	2
Technician	7
Other	5
TOTAL	36

Solid waste pollution control is divided into three categories: Collection, Disposal, and Resource Recovery/Energy Conversion (RR/EC). Current private sector workforce levels were estimated with the help of IEPA personnel.

As for collection, it is estimated that presently there are about 10,000 people employed as chaffeurs, helpers and jumpers, and in management. This figure was arrived at by using Springfield (population about 130,000) employing an average crew size of two for some forty trucks with an estimated thirty people involved in management as an index for the state (population 11,000,000).

There are approximately 2,220 people employed throughout the state in disposal activities at the 465 solid waste disposal sites. To determine this estimate it was assumed that each site had an average crew size of 4.75. Such positions might be owner/operator, weighmaster, equipment operator/mechanic, laborer, spotter, materials handler and assistants to the owner or operators. Crew size varies considerably. Twenty or more may be employed at a large urban area site; a single individual working part-time may be responsible for operating a small rural site.

The RR/EC workforce level is presently estimated at approximately seventy-five. This figure represents individuals working full-time at fifteen or sixteen landfill sites where RR/EC activities are conducted and those employed at the City of Chicago/Commonwealth Edison RDF plant.

The following table presents the current private sector workforce profile.

TABLE XVI

STATE OF ILLINOIS

Current (1976) Private Sector Solid Waste Workforce

	1976
Collection	10,000
Disposal	2,220
RR/EC	75
TOTAL	12,295

Specific information as to position title was not available as many functions are combined, even in the larger operations.

The Division of Nuclear Safety, Illinois Department of Public Health, supervises operation of the Sheffield low-level radioactive waste disposal site in Bureau County. The site was authorized by the 1963 Radioactive Waste Act; operations began in 1967 under a lease agreement with a private contractor, Nuclear Engineering Company Inc. Only solid waste with a maximum concentration of one Curie per cubic foot may be buried on the state-owned twenty acre site.

IDPH conducts quarterly site inspections, collects on- and off-site samples, and conducts periodic special programs of audit, inventory, and analyses. The IDPH personnel whose responsibilities include the above are discussed in the Radiation component of this study.

The operator, Nuclear Engineering Company, is required to monitor the site and to provide IDPH with extensive reports, records, and inventories

of location, amount and types of waste buried. The site is nearing capacity under current conditions and methods of burial; expansion is hampered by zoning regulations. A program to expand the capacity of the twenty acre site is being developed, but will require regulatory approval before the "cut and fill" plan may be implemented.

Although verbal and written requests were submitted to Nuclear Engineering, for information regarding the Sheffield site workforce, the company failed to respond. IDPH estimates the Sheffield site workforce to be about 30; no expansion is anticipated.

C. Workforce Projections

The IEPA positions in solid waste management are not expected to increase more than two or three percent per year over the next few years. An exception to this may be due to the addition of personnel as a result of RCRA toward the end of the five year period. This is unpredictable at this time.

The following table depicts the expected increases in the public solid waste management workforce. The rate of increase is expected to be between two and three percent per year. It is not certain in which job categories the increases will occur.

TABLE XVII

STATE OF ILLINOIS
IEPA Division of Land Pollution Control
Solid Waste Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum growth (average)
Engineer	7	7	7	7	8	8	n/a
Chemist	1	4	4	4	4	4	n/a
Geologist	2	9	9	9	9	9	n/a
Sanitarian	12	2	2	2	2	2	n/a
Attorney	2	2	2	2	2	2	n/a
Technician	7	7	7	8	8	8	n/a
Other	5	6	7	7	7	8	n/a
TOTAL	36	37	38	39	40	41	2-3%

The total employment situation in the private sector of solid waste management, which includes projected growth, turnover, upgrade training, job attrition and termination, based on best professional judgements is reflected by the following table. Specific job classification data are unavilable.

TABLE XVIII

STATE OF ILLINOIS

Private Sector Solid Waste
Workforce Projections to 1982 (est.)

	1976	1977	1978	1979	1980	1981	%/annum growth (average)
Collection	10,000	10,700	11,449	12,250	13,108	14,025	n/a
Disposal	2,220	2,264	2,309	2,355	2,402	2,450	n/a
RR/EC	75	75	75	90	*	*	n/a
TOTAL	12,295	13,039	13,833	14,695	15,510	16,476	

*Dependent upon the effects of the implementation of the Federal Resource Conservation Recovery Act which cannot be estimated at this time.

The preceding projections for collection activities are based on a straight line two percent increase in staffing needs and an annual turnover/attrition rate of five percent. The disposal figures are based on a straight line two percent increase. The larger operations predict an annual growth at landfill sites ranging from five to ten percent; however, some of this growth will be offset by abandonment of smaller sites. The 1979 figure for RR/EC reflects the opening of the Springfield refuse derived fuel plant. Growth beyond that year may be extraordinary due to the effects of RCRA, but are unpredictable at this time.

The figures are not broken down by position title as many functions are combined, even in the larger operations.

Illinois Environmental Protection Agency positions are not expected to increase in the near future. An exception to this may be due to the addition of personnel as a result of RCRA.

All indications are that growth in solid waste management will be small (about 2 percent) for the next few years with the notable exception of a dramatic increase in RR/EC activities and positions toward the end of the five year period.

D. Training and Certification

Certification for owner/operators appears to be a matter of low priority according to IEPA administrators. At the present owner/operators are required only to obtain an appropriate permit to operate a sanitary landfill. Formal certification is not yet required and permits are issued if the individual/company is able to meet the standards for operating a sanitary landfill.

IEPA has offered one and two-day seminars for owner/operators at several locations across the state. These seminars, conducted by IEPA staff, reviewed rules and regulations governing operation, explained developments in the field and presented manuals, lectures and films dealing with correct landfill operation, e.g., RR/EC activities, materials handling, landscaping and site reclamation. IEPA has trained more than 550 owners/operators in this fashion.

E. Career Potential

Many positions in solid waste disposal are filled by people moving up through the ranks, often by those who began as jumpers or drivers. Much hiring is done through union halls. The larger companies may begin to hire

engineers, geologists and hydrologists, but only one or two per company and only as a need is perceived by management. Those companies which handle hazardous and liquid wastes will be hiring chemists and technicians for testing materials before disposal, but this, too, will have minimal impact. Chemists with an understanding of solid waste disposal requirements and techniques will be particularly sought after.

Central processing and resource recovery from wastes, when implemented, will change the employment profile of those companies involved in these activitie extensively.

F. Conclusion

The most significant changes in solid waste management in Illinois will be due to implementation of the Resource Conservation and Recovery Act. Resource recovery activities will increase and effect an increase in workforce demand for chemists, planners, hazardous waste management specialists, engineers, and complex machine operators.

Solid waste management programs, such as those already begun under the aegis of the federal government, will become increasingly important as landfill operations become more diversified and complex. Future regulations, both at the state and federal level, will require the training and formal certification of all Illinois sanitary landfill owner/operators as well as additional training for those entering the solid waste field. These changes will not begin to be felt until at least 1979 or 1980.

VII. WASTEWATER

A. Introduction

The field of wastewater processing in Illinois has proceeded much as was discussed and projected in the first Illinois report. The proposed changes in certification classification for operators have been instituted; the training program developed by the Illinois Environmental Protection Agency (IEPA) outlined in the first report has been implemented. The development with the greatest impact is the completion of the Environmental Resources Training Center (ERTC) for pollution control operator training. These changes will be discussed at length below.

Illinois does not now have National Pollution Discharge Elimination System (NPDES) authority and is giving very careful consideration to the problems and benefits derived from acquiring such authority. At the present, it appears unlikely that the state will accept primacy. The effects upon the workforce, whether primacy is accepted or not, are not clear.

There are approximately 2,400 municipal and private treatment plants in Illinois. One-half are staffed by as many as thirty a shift, operating around the clock; the others are one or two-man operations.

The previous IEPA, Division of Water Pollution Control, estimate of 10,000 people employed in the 2,400 facilities across the state still holds. As of December, 1976, IEPA records showed 2,201 wastewater treatment plant personnel to be certified operators. This apparent reduction from the 2,431 reported in the previous study is due to an extensive effort by IEPA personnel to clear the certification files of inactive certificates. It was estimated at the start of the file clearing that as many as ten percent

would be found to be inactive; in fact, the number far exceeded ten percent. The December, 1976, total of 2,201 is of active certificates and represents a substantial increase over the active certificates included in the number reported previously.

The IEPA 1974 estimate that 3,000-5,000 people already in the field will need further education to meet future requirements in wastewater processing is still considered valid.

B. Workforce Profile

Information for the workforce profile was obtained through interviews with IEPA, Division of Water Pollution Control, personnel. Mr. Ernest Bennett, P.E., Manager of the Operator Certification and Training Unit, was especially helpful in providing an understanding of wastewater programs in Illinois. The assistance of Mr. Bennett and Mr. James O'Bryan in compiling data was of the highest quality.

The IEPA Division of Water Pollution Control is organized into five regions and maintains seven offices. They are as follows:

Region I--Rockford
Region II--Maywood (Also covers the area formerly served by the Aurora office which has been closed)
Region III--Springfield, Champaign, Peoria
Region IV--Collinsville
Region V--Marion

The Division of Water Pollution Control currently has a head count of 196 persons, of which 142 are engineers, administrators and scientists. The 54 remaining are clerical/para-professional. Table XIX illustrates the distribution of staff within the Division.

TABLE XIX

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Division of Water Pollution Control
Current (1976) Staffing Level

Position	Field Offices	Main Office	Total 1976
Engineer	33	43	76
Resource Planner	0	9	9
Environmental Protection Specialist	19	8	27
Attorney	0	9	9
Administrator	0	4	4
Accountant	0	6	6
Environmental Protection Technician	11	2	13
Aquatic Biologist	6	0	6
Clerical	15	31	46
TOTAL	84	112	196

The resource planners have a minimum of a four-year degree in resource planning or urban planning. Environmental protection specialists have Bachelor's or Master's Degrees in the natural sciences or chemistry. Environmental protection technician positions require a high school education and extensive on-the-job training. The aquatic biologists have a minimum of a four-year degree.

The Division of Water Pollution Control responsibilities include the following:

1) Approval of construction plans specifications for new facilities to ensure compliance with state regulations;

2) Certification and training of wastewater treatment operators;

3) Monitoring to ensure compliance with water quality standards;

4) Enforcement of regulations regarding properly certified personnel for wastewater treatment facilities.

The staffing level will probably remain constant for some time due to the job freeze affecting all state employment.

Table XX presents the distribution of certified wastewater treatment plant operators in Illinois by operator classification (I is the highest).

TABLE XX

STATE OF ILLINOIS

Certified Wastewater Treatment Plant Operators
Current (1976) Staffing Level

Classification	1976
I	173
II	318
III	422
IV	858
VII	430
TOTAL	2,201

As of September, 1974, Illinois operator certification classifications were reduced from seven to five categories, I-IV and VII. Class V certificate holders were upgraded by examination or declared uncertified and dropped. A total of 396 were dropped; many of whom have since regained certification. Class VI temporary certificates were eliminated.

IEPA personnel estimate the 2,201 certified operators to include as many as 200 degreed engineers and up to 500 college and university trained biologists, chemists and laboratory technicians. There are no data available concerning the breakout of treatment facilities' employees as to administration, labor, or maintenance.

The Chicago Metropolitan Sanitary District (MSD) controls certification of operators under its jurisdiction. Efforts are being made to institute a reciprocal arrangement between the MSD and IEPA regarding certification examinations and validity of certificates.

Figures 6 through 11 present an organizational chart for a wastewater treatment plant serving 100,000 population. The chart was developed by IEPA, Division of Water Pollution Control.

C. Workforce Projections

The staffing level in the public sector is likely to remain constant for some time (see Table XX) due to budgetary constraints, although IEPA personnel anticipate a need for additional people to deal with future developments within the program.

Workforce projections for the private sector are indicated in Table XXI. They are based on past trends as evidenced by IEPA certification records. The projections reflect adjustments in the growth rates to correct the factor of error due to previously counted inactive certificates.

TABLE XXI

STATE OF ILLINOIS

Wastewater Treatment Plant Operators (Certified)
Workforce Projections to 1982 (est.)

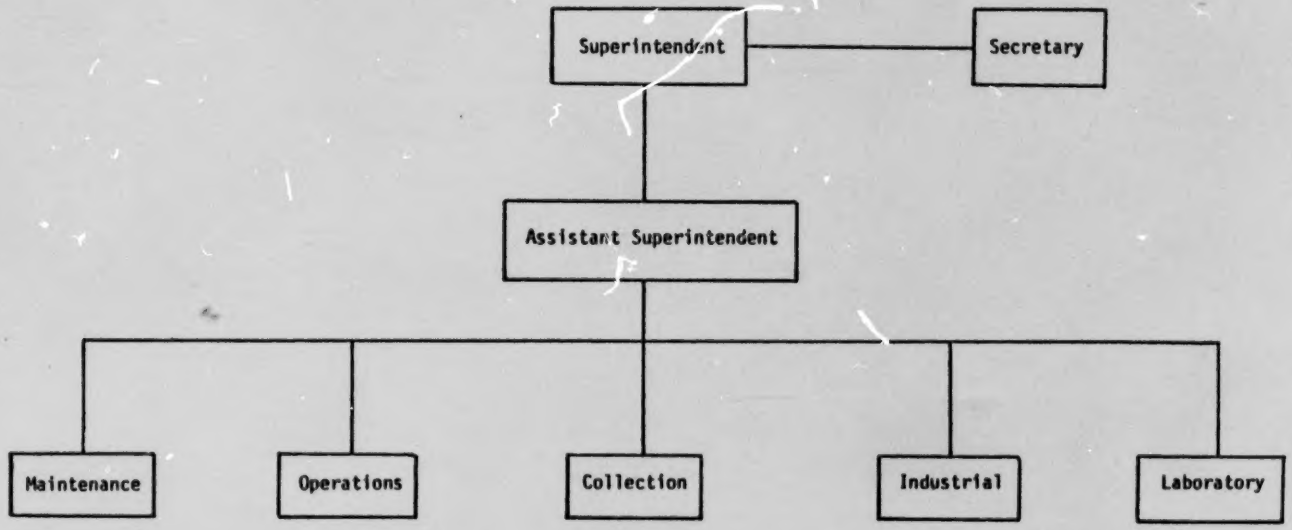
Classification	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
I	173	187	202	218	235	254	n/a	8%
II	318	351	388	429	474	524	n/a	10.5%
III	422	468	520	577	640	710	n/a	11%
IV	858	905	955	1008	1063	1121	n/a	5.5%
VII	430	484	545	613	690	776	n/a	12.5%
TOTAL	2201	2395	2610	2845	3102	3385		9%

The above table depicts only certified operators which presently comprise 22 percent of the total private sector workforce. The table represents changes due to new entry and upgrading. The projected per annum growth for the next five years for certified wastewater treatment operators is 9 percent,

ORGANIZATIONAL CHART

Waste Water Treatment Plant: 100,000 popul[illegible]

Figure 6

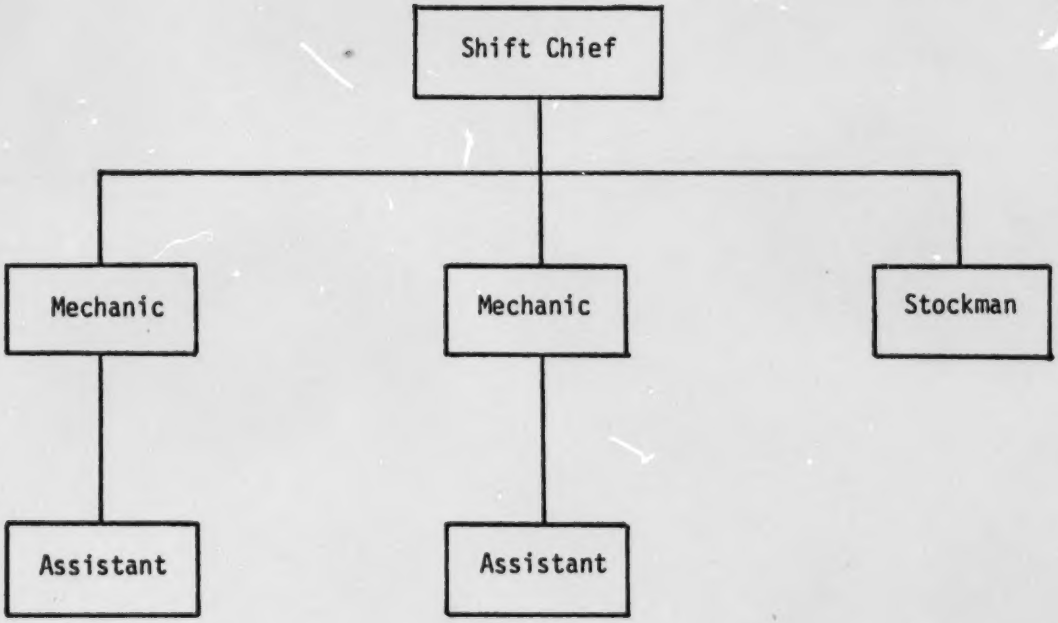


Source IEPA

Model Waste Water Treatment Plant

(Maintenance Division)

Figure 7

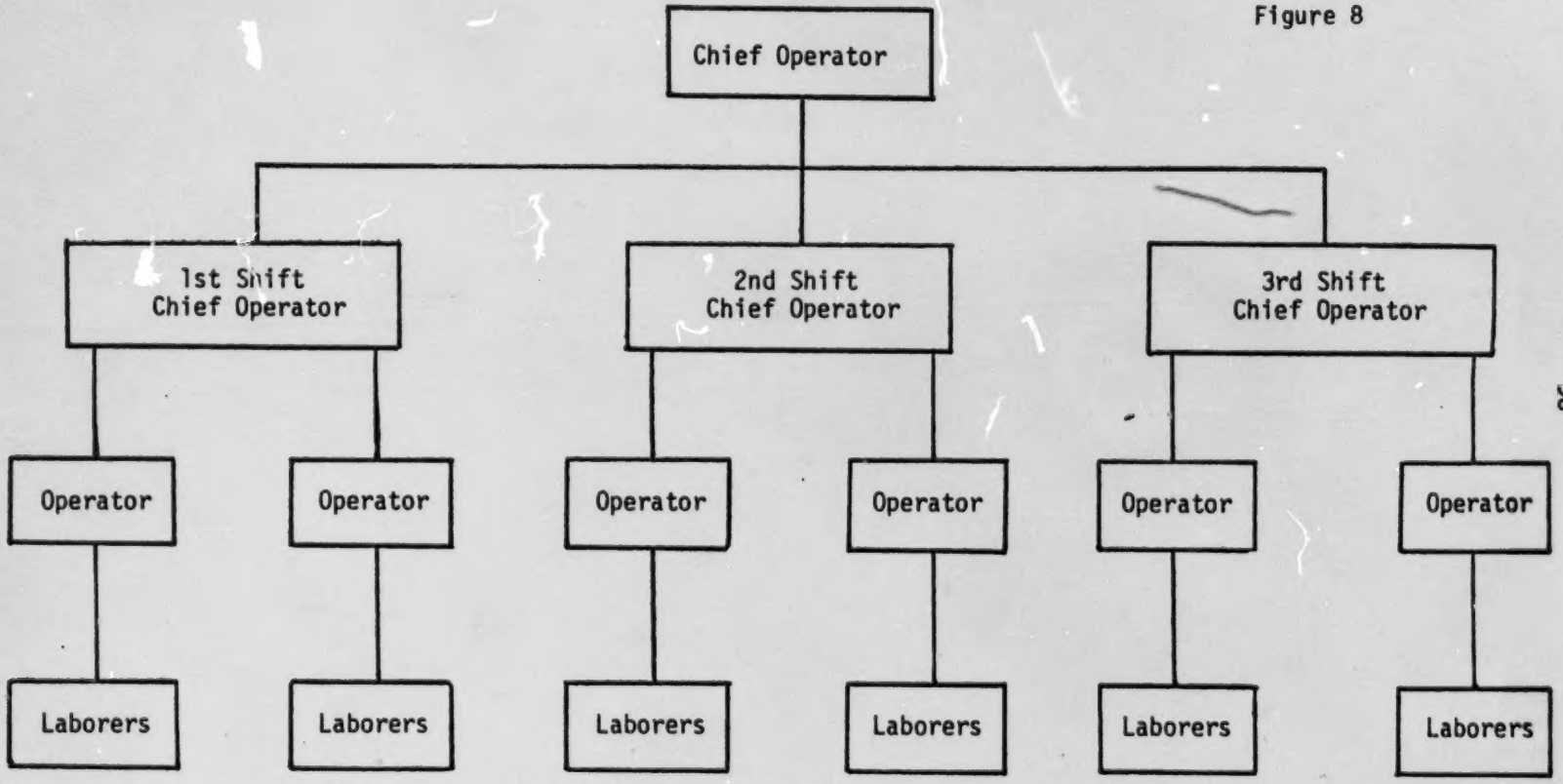


Source IEPA

Model Waste Water Treatment Plant

(Operations Division)

Figure 8



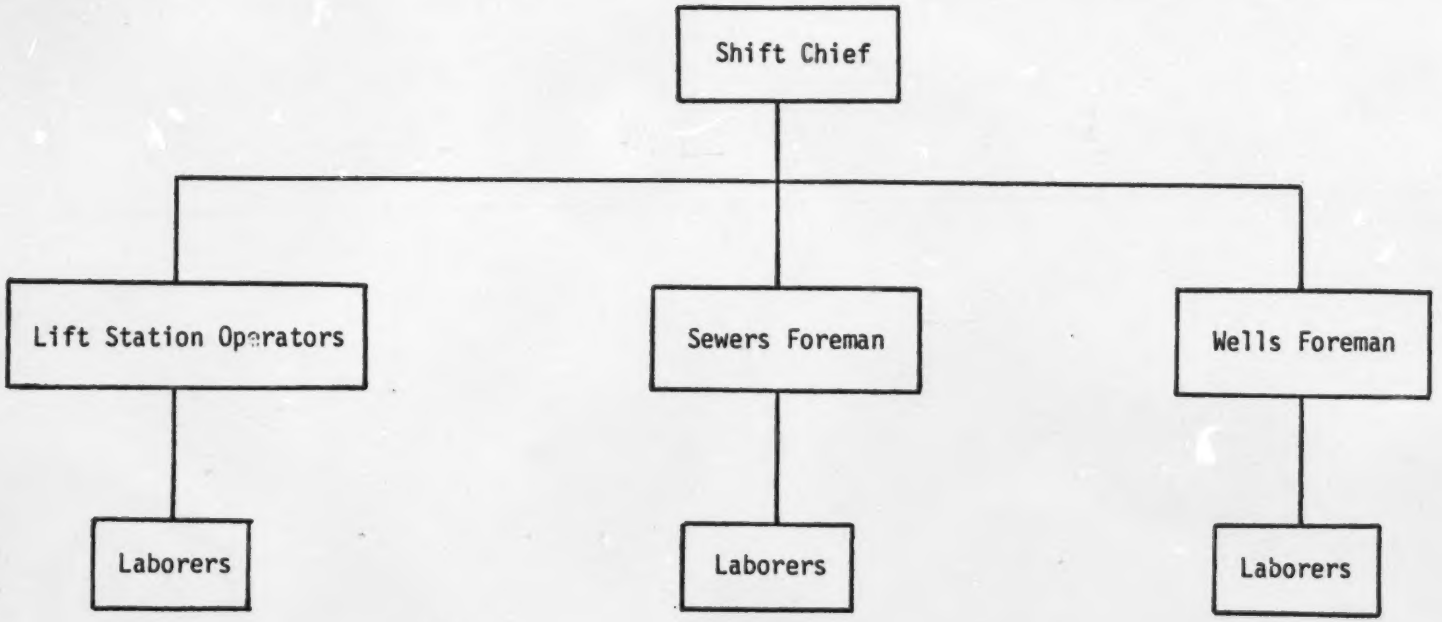
98

Source IEPA

Model Waste Water Treatment Plant

(Collection Division)

Figure 9

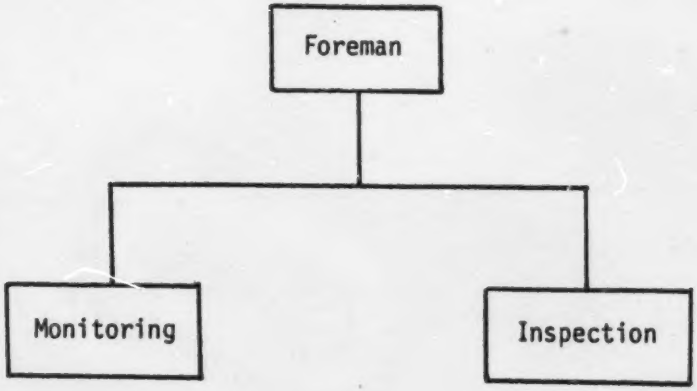


Source IEPA

Model Waste Water Treatment Plant

(Industrial Division)

Figure 10

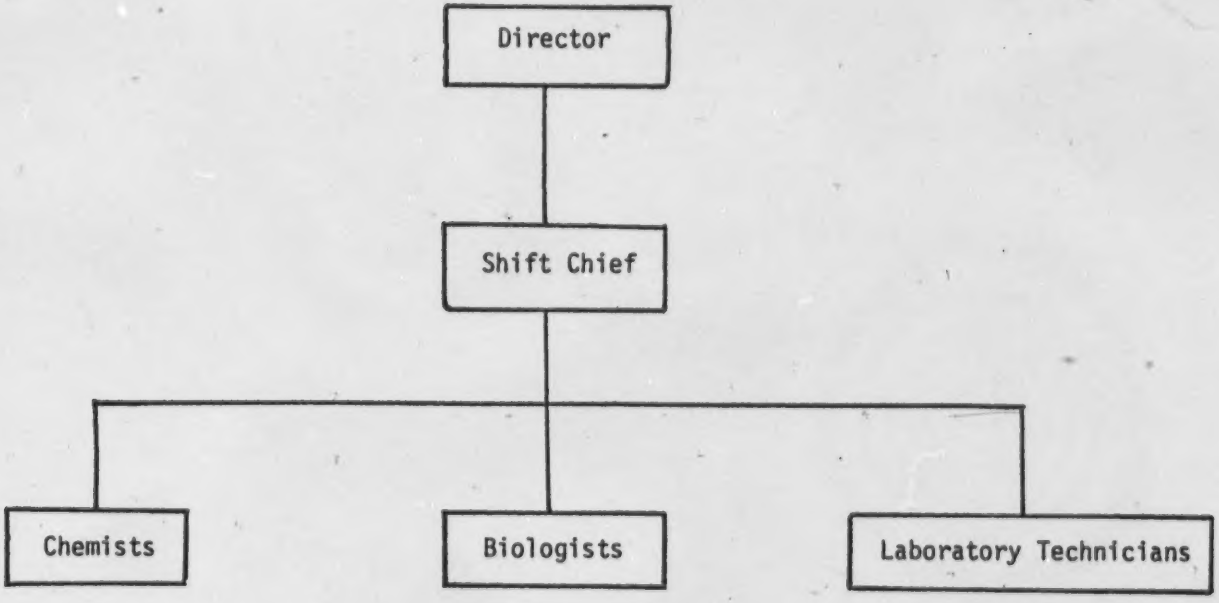


ource IEPA

Model Waste Water Treatment Plant

(Laboratory Division)

Figure 11



101

Source IEPA

in aggregate. No specific turnover rates are available. Turnover is highest in classifications III and IV, primarly due to low salaries in municipal plants compared to similar positions in industry.

Specific workforce profiles and projections cannot be determined for wastewater treatment plant positions other than certified operators. Growth will occur in administrative, labor, and maintenance positions but such growth will not be at a rate equal to the growth of the number of certified operators. The basic reason for disproportionate growth rates is due to IEPA's intensive efforts to train existing operator personnel to meet the requirements of certification; thus, a major proportion of the increase in certified operators is composed of persons already working in the field.

D. Training and Certification

The Illinois wastewater report prepared in 1974 outlined the IEPA plan for broadened training and certification efforts to be implemented in FY 1975. The plan consists of five separate but interrelated elements; Element I is complete and Element II is well underway. The plan has been most successful to date and is reprinted here with notations as to the current status of the various elements.

Element I (Completed June 30, 1976)

Management Incentives: To substantially increase the awareness and support of municipal officials in the need for optimum operation and maintenance of wastewater treatment facilities through 20-25 seminars reaching approximately 1,000 to 1,200 officials.

The Element will be structured around 20-25 seminars combining slide, tape, and live presentations. The individual seminars

will be designed to: 1) appeal to and train municipal officials in manpower planning for wastewater pollution control; 2) enlist municipal officials in support of pollution control efforts; 3) acquaint officials with the specific purposes, needs and benefits of pollution control facilities and pollution control operators. Specifically, it will include the incentives and benefits to be realized by enrollment in the operator training program, particularly Element III.

The seminars, which are planned for presentation during the first four to six months of the project, will be led by one or more individuals (e.g. engineers, operators, etc.) knowledgeable about State and Federal regulations, and wastewater treatment facility operation and maintenance procedures.

Element II (On-going--will be completed June 30, 1977) Instructor Development: To train or upgrade the level of 24 operator instructors through the development and demonstration of innovative instructor development techniques. After development, these instructor techniques will be available to train additional replacement instructors.

An estimated 3,000 to 5,000 operators of wastewater treatment facilities require or will require some form of initial or upgrade training over the next several years. It is a generally conceded concept that it is more feasible to provide technically trained and experienced operators

with instructor skills and capabilities, than to technically qualify experienced instructors in facility operation. Furthermore, since not only technical knowledge but operational experience is a vital factor in a viable, practical training program, it may be readily discerned that the utilization of experienced operators as operator instructors is to be encouraged.

Element III (To be completed June 30, 1977) Operator Training/Assistance: To optimize the operation and maintenance of 50 wastewater treatment facilities through intensive operator training and assistance, and to provide varying degrees of in-plant, in-depth, specialized assistance to an additional 100 facilities. This Element will also be utilized to improve operator assistance capabilities of Agency staff, particularly staff not currently experienced in this area.

This Element will consist of two categories. Category A will consist of 50 wastewater treatment facilities where operation and maintenance problems are extensive or severe in nature. Priority will be given to those operators at plants where requests for grant funds have been made and where: a) it is unlikely that grant funds will be available within the reasonable future; b) the facility has available design capacity; c) it appears that operation and maintenance can be significantly improved through intensive operator training and assistance.

The fiscal year 1975 grant priority list will be screened for possible candidates among those grant applications with priority numbers of greater than 300. Additional candidates will be nominated by IEPA staff considering such factors as: a) design available capacity; b) relative difficulty and expense of correcting any physical plant deficiencies; and, c) general operator related operation and maintenance deficiencies.

Approximately 50 facilities and operators will be selected by not later than 30 days after the completion of Element I for inclusion in Category A. Facilities and operators will not be accepted into the program until both the operator and the facility owner have concurred with the program objectives and intent, and agreed to participate fully. When a facility and operator have been so enrolled, both the operator and his plant will be pre-evaluated to establish base-line performance. Based upon evaluation, a training routine and schedule will be developed for the specific operator and facility. Subsequent achievement evaluations will be made to determine improvements in operation and maintenance. Such evaluations (pre-, continuing, and post-evalutions) will include both objective and subjective appraisals. Objective evaluations may include, but will not necessarily be limited to, appraisals of final effluent and stream condition. Subjective evaluations will include appraisals of the operator, facility, and supportive

activities of the facility owner by program staff. Enrollees and municipal officials enrolled in the program may also be asked to evaluate achievements. Evaluations will consider such items as facility monitoring reports, record keeping activities, laboratory facilities and techniques, maintenance programs, and comparative evaluation of unit process efficiencies.

Category A operator enrollees will be enrolled in training courses wherever feasible. Such courses will be generally taught by operator/instructors trained under or engaged in training under Element II of this project. Such concurrent training will permit the use of the "normal classroom situation" as an inherent part of the instructor development Element.

In addition to formal classroom training, Category A operators will receive specific hands-on training and assistance under the tutelage of experienced operators or similarly qualified individuals. Assistance will also be rendered in relationship to specific problems experienced by the operator in the operation and maintenance of his facility. He will be encouraged and assisted in establishing an active maintenance program for his facility. He will be encouraged to seek certification as a means of evidencing his technical competency as a wastewater treatment facility operator. Wherever practical and feasible, his immediate supervisor and/or the supportive personnel associated with

the wastewater treatment facility will be encouraged to interact and participate within the program framework. Heavy emphasis will be placed on developing operator and owner pride and sense of accomplishment in the wastewater treatment facility operation and maintenance. Mechanisms for continuing operator recognition will be encouraged.

Within Category B approximately 100 operators from plants with minor operation deficiencies will be selected during the 24 month project for short-term, limited vis-a-vis instruction and assistance regarding specific problems or difficulties in operation and maintenance. Most operators so selected will have a general knowledge of wastewater treatment facility operation. However, where it appears that general knowledge of wastewater treatment facility operation and maintenance is inadequate or lacking, the operator will be encouraged to enroll in a regular institutional training program. It is the intent of this category, then, to provide selected operators with assistance and solutions to specific treatment phase or unit problems.

Although all operators of wastewater treatment facilities will have access to operator assistance by general field staff of the Illinois Environmental Protection Agency, such assistance is limited to an average of approximately 6 man-hours per plant per year. The 100 selected facilities under

Category B will be offered intensive assistance averaging approximately 3 man-days per plant through the use of full time or contractually retained experienced operators and similarly qualified individuals. The assistance provided to Category B operators will, in general, be of the nature and extent requiring time and knowledge beyond the ken of general field staff. Where appropriate and feasible, field staff will accompany and assist vis-a-vis instructors as a step toward enhancing field operation activities of the Field Operations Section of the Agency.

Element IV (Ninety percent complete)
Centralized Instructor Aids: To develop an inventory of training aids as an adjunct to improved operator training techniques.

To the degree possible, a centralized inventory and repository of instructor aids should be developed. This will include cataloging available loan or rental materials from various pertinent informational sources, particularly in Illinois. A portion of this work has already been accomplished. Charles County Community College in La Plata, Maryland has published a list under the title, Instructional Materials Available. In addition, the Operator Certification and Training Unit of the Field Operations Section, Division of Water Pollution Control, along with a group of interested operator/instructors has commenced compilation of a similar list of materials in Illinois. Certain instructor aids are

readily available and used with sufficient frequency to warrant procurement by individual educational institutions. It is not the intent of this Element to stockpile or unnecessarily accumulate training materials, or to restrict their accessibility. However, due to their relatively high cost, accumulating such materials can only be justified by maximizing utility among several educational institutions. Examples may be demonstration or working models of unit processes, movies, and video-tape presentations. In some instances, manufacturers and research organizations are willing to make such materials available for training at little or no cost to training components. To the extent possible, funds should be made available for the purchase and transport of such materials. Where the expenditure for a single item exceeds $100 in total amount, prior approval of the funding agency will be sought prior to commitment.

As pointed out before, this element does not intend to accumulate a large inventory of specialized training material, but rather to: a) develop a catalog system of such materials, and to provide the mechanism for their inter-loan among instructors; and, b) where practical and feasible, to inventory and make available such training aids as may not otherwise be practically available.

Element V (Evaluation)

Program Evaluation: To evaluate the activities of Elements I through IV and determine whether or not a significant improvement in wastewater treatment facility operation and maintenance has transpired.

This Element will consist of two phases. Phase I evaluation: a) pre-evaluation to establish base-line data for reference to Elements II, and III; b) continuing evaluation to monitor the progress of the program in Elements I, II, III; and, c) post-evaluation to determine program achievement in Elements I, II, III; and the Phase II project report. The purpose of the project report is to draw relevant conclusions, in terms of efficiency, benefits, and accomplishments, from the Program for Optimum Operation Practices. Evaluation personnel will make recommendations as to the termination or continuance of various Elements under general Illinois EPA or federal budgetary provisions.

In 1976, sixty-eight courses in wastewater treatment procedures were offered through community colleges in twenty-four locations. The average class size was twenty students; although many persons were enrolled in more than one course. IEPA personnel taught several of the courses and trained instructors simultaneously.

Advanced training techniques have continued to receive high priority in IEPA training courses. IEPA staff feel the efforts have been most effective.

The Water Pollution Control Division of IEPA conducted thirty-three seminars and workshops in 1976. The one and two-day sessions conducted

throughout the state included programs in management awareness, health and safety, equipment operation, maintenance, mathematics, treatment techniques, and informative sessions for municipal officials.

The most significant development in training wastewater operators in Illinois has been the completion of the Environmental Resources Training Center (ERTC) at the Southern Illinois University, Edwardsville campus, at a cost of more than two million dollars, all from state funds.

ERTC is a unique facility which includes classrooms, laboratories and a wastewater treatment plant. The first classes began in January, 1977.

The program goals for ERTC are as follows:

1) To teach direct training courses at the Edwardsville site. Entry level and advanced courses and seminars will be offered;

2) To develop a cooperating network of community colleges which offer pollution control operator training courses to encourage consistency and transferability of course-work;

3) To offer instructor development training courses;

4) To develop training aids and course curricula and to maintain a library of training materials which can be loaned to a community college or treatment plant for use in training courses;

5) To conduct applied research related to operation and maintenance of pollution control equipment and processes.

E. Career Potential

As no growth can be considered likely in the public sector (specifically, the IEPA Division of Water Pollution Control) due to budgetary constraints, career opportunities will be extremely limited. In some instances even turnover may not be replaced due to the job freeze now in effect for state agencies.

Opportunities in the private sector will be fairly substantial; primarily due to more stringent enforcement of existing state and federal regulations. Certified wastewater treatment operators are expected to increase at a rate of 9 percent per annum. The bulk of the openings will occur at the entry level (Classification VII). There will be some expansion in opportunities for administrative, labor and maintenance personnel, but these positions will not increase at a rate comensurate with the rate of growth for certified operators because the certified operators increase includes a substantial number of persons already working but not yet certified.

F. Conclusion

Wastewater treatment plant operator training and certification efforts have continued to be of major concern to the IEPA Division of Water Pollution Control. Specific evidence of the effects of this emphasis include the reclassification of operator certificates, implementation of the plan for improved training developed in 1974, the completion of the ERTC facility at Edwardsville, and the substantial increase in the number of operators holding active certificates.

These activities in training development will have a substantial effect on the quality of wastewater treatment in Illinois. The operator component of the workforce will witness a marked increase in the next five years. Training for such persons will be available and will be of high quality.

VIII. ENERGY

A. Introduction

Illinois holds a prominent position, nationally, in two significant aspects of energy considerations for the future: coal and nuclear power generation.

Coal was discovered in Illinois in 1673, by Joliet and Marquette. Two centuries later (1877) James MacFarlane, in Coal Regions of America, summarized the situation regarding coal in Illinois which is applicable today, "The valuable features of Illinois coal are that there is plenty of it, that it is widely distributed over the State...and, poor as the coal is, there is a large market for it, for want of better."

Coal formations underlie 65% of the state (36,806 square miles, see Figure 12). Illinois has the largest reserves of bituminous coal in the country. North Dakota and Montana have larger reserves but much of it is sub-bituminous coal or lignite. Total Illinois reserves are estimated at 161 billion tons. Recoverable reserves (those presently economically and technologically feasible to extract) are estimated at 65 billion tons.

Illinois ranks fourth among the states in coal production. For more than ten years, the annual production has fluctuated between 55 and 65 million tons. In 1975, 59,530,476 tons were extracted.

Production and employment have varied considerably in Illinois' coal industry. Both peaked in the early 1920's. In 1923, there were 99,081 persons employed in mining coal. Production increased during World War II; employment had a slight respite from its steady decline. Production's

Figure 12

COAL FORMATIONS IN STATE OF ILLINOIS

Operating coal mines as of October 1973. (Source: Illinois Department of Mines and Minerals.)

post-war low came in 1954, when only 40,000,000 tons were mined; employment, in response to technological innovations, continued to decline to a low of 8,054 in 1967 (see Figure 13).

During this period, the trend was to fewer, larger mines. In 1920, there were 373 mines operating; in 1968, only 48. Concurrently, the proportion produced by strip mine operation was only .005% of the total coal extraction of 1920; strip mined coal accounted for 58% of 1967's production.

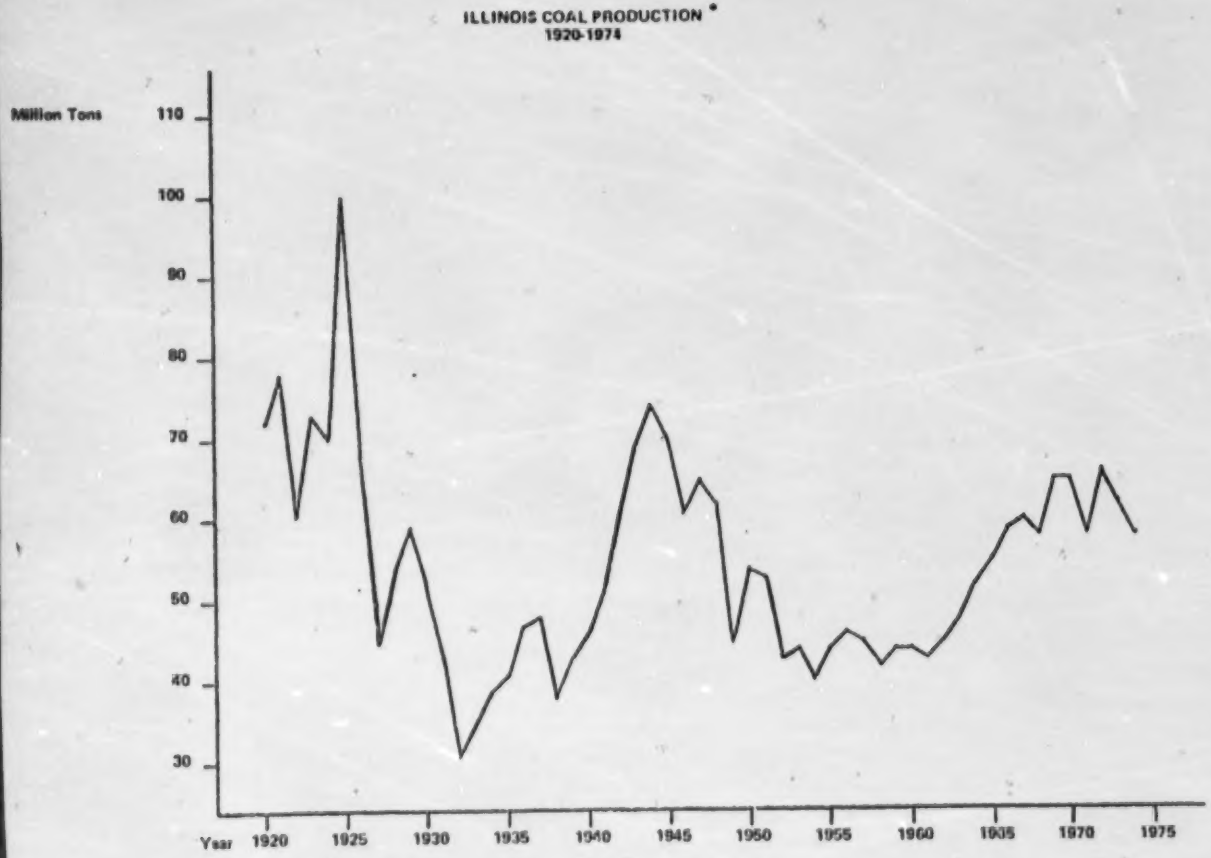
Statistics from 1969 through 1974 are not comparable with prior years as several small local strip mines were added to the data base which had not been included in previous reports. Essentially, production remained fairly steady; employment rose somewhat.

By 1974, there were 55 mines; 23 underground, 32 strip mines. In 1975, miners had increased to 13,623.

Thirteen major new mines are being constructed; all are expected to be operating at full production rates by 1982. They include one slope, four strip, and eight deep mines. The annual production of these new mines is expected to be 27 million tons. Several smaller strip mines have also begun operation since 1974. If the Tennessee Valley Authority exercises its option to purchase 300 million tons of coal in a 23,360 acre tract, another mine will be opened.

Figure 14 presents a profile of past and projected energy consumption in Illinois.

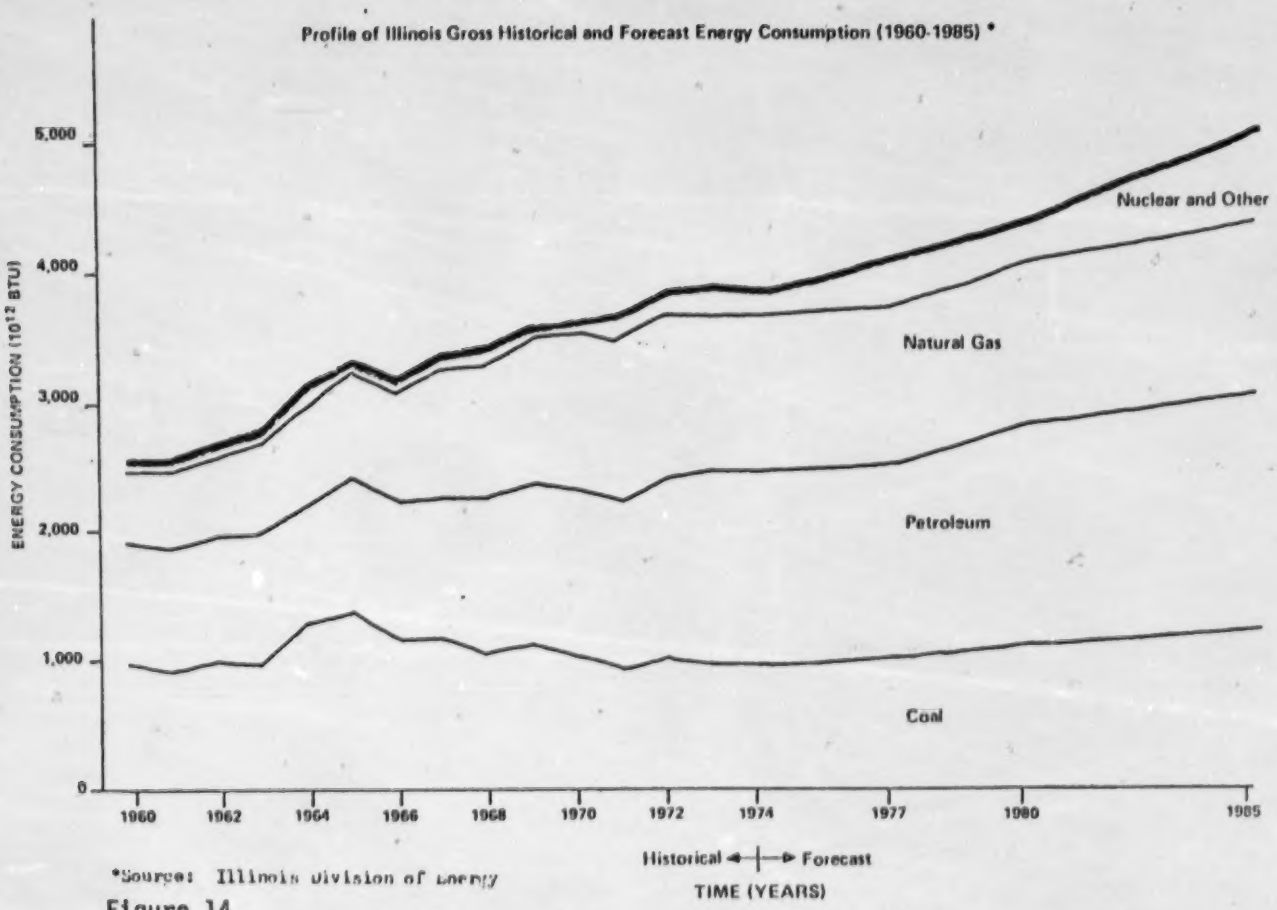
Illinois consumes 9% of the coal extracted in the United States. It ranks third in consumption, behind Ohio and Pennsylvania. Electrical power generation accounts for 80% of Illinois' consumption. Table XXII depicts



Data Source: "1974 Annual Coal, Oil and Gas Report", Illinois Department of Mines and Minerals.

*Source: Illinois Division of Energy

Figure 13.



*Source: Illinois Division of Energy

Figure 14.

the flow of bituminous coal as it is produced, exported, imported, and used in Illinois.

TABLE XXII

ILLINOIS BITUMINOUS COAL FLOW, 1974
(in tons)

Produced	Exported	Imported	Used
58,073,000	32,719,000	13,700,000	39,054,000

SOURCE: U.S. Bureau of Mines

Table XXIII presents the distribution of the consumption of coal in Illinois.

TABLE XXIII

COAL CONSUMPTION IN ILLINOIS, 1974
(in tons)

Use	Amount
Utilities	30,837,000
Coke and Gas Plants	3,100,000
Residential and Commercial	772,000
Industrial and Other	4,345,000
TOTAL	39,054,000

SOURCE: U.S. Bureau of Mines

The high sulfur content of Illinois coal was recognized to reduce its quality long ago. It is unsatisfactory for the production of coke except when mixed with Pennsylvanian coal. The sulfur greatly jeopardized the marketability of Illinois coal for use in electric power generation (the lion's share of coal use) as air pollution standards established across the country in the last decade set limits for sulfur dioxide (SO_2) emissions

which could not be met when burning Illinois coal unless capital intensive pollution control equipment was installed.

The effects of air pollution legislation are dramatized by changes in the source of coal burned in Illinois power plants. In 1970, only 3.7% of the coal used by the utilities was imported. In 1974, 24.5% of the coal used to generate electricity in Illinois was low sulfur Western Coal.

In 1974, Illinois embarked upon a comprehensive coal and energy development program. A primary objective was and remains to promote the production and use of Illinois coal. The Illinois Coal Development Bond Act of 1974 provides $70 million for, "research, development, and demonstration of improved methods of discovery, production, transportation, sale, distribution, conversion, end use and waste disposal of coal resources."

The Department of Business and Economic Development (BED), Division of Energy (DOE) has received $10 million (Fiscal Year 1978) for administering the bonding authority (DOE activities are discussed below).

The Illinois Coal Development Bond Act (Public Act 78-1122) established the Illinois Energy Advisory Council on Coal Development. The council is chaired by the governor; the members are the directors of seven cabinet departments. It is empowered to:

1) solicit, accept, and expend funds from any source, including the federal government;

2) make contractual arrangements with business, industry, government, and universities to promote development of coal resources, and to contract "for planning, design, acquisition, development, construction, improvement, and financing a site or sites and facilities for establishing plants, projects, or demonstrations for development of coal resources";

3) acquire property by exercise of the power of eminent domain.

Several schemes have been set forth which combine state, federal and industry monies in variety of coal development and conversion research and demonstration projects and facilities.

One facility has been operating for several years. The HYGAS Pilot plant, Stickney, Illinois, is operated by the Institute of Gas Technology of the Illinois Institute of Technology. The plant produces pipeline gas from coal by hydrogasification.

The State has committed $25 million from Coal Development Bond monies for development of a federally-supported coal conversion plant to be located in New Athens. The plant will be operated by the Coalcon Corporation, a joint venture of Union Carbide and Chemical Construction Co., a unit of General Tire's Aerojet-General Corporation. The Coalcon project, not yet scheduled for construction, will be a Medium Btu Coal Gasification Liquification demonstration plant. It could become one module of a commercial operation.

The Illinois Coal Gasification Group, a consortium of five Illinois Utilities, is awaiting an engineering and feasibility study from the Energy Research Development and Administration (ERDA) for a High Btu Gasification plant in Perry County near Percy, Illinois.

Commonwealth Edison has planned a Combined Cycle Low Btu Coal Gasification plant (the Powerton Project) to be located at the Powerton Electric Generating Station, Pekin, Illinois. Construction may begin by the fall of 1977. Current estimates indicate the plant will be on line by September, 1979. It is a test facility and will employ 100-120 people.

Although the state has placed a high priority upon the attraction and support of coal conversion facilities, this is not considered by many to be an ideal solution to the Illinois high-sulfur coal problem for several reasons.

A commercial gasification plant would process about 6 million tons of coal per year. This represents approximately 10% of the state's current annual coal production. To meet this increased demand, more new mines, with a resultant loss to agriculture land, will have to be developed.

Of further concern is the effect on the water resources of the state. Estimates for water usage of such a plant range from an extreme low of 6 million gallons a day for a plant which exercises severe water conservation methods to an extremely high daily usage of as much as 72 million gallons. Ten million gallons a day is estimated to be needed for a standard size plant. In addition to the effect on the water supply, agricultural land may be lost if reserviors must be constructed.

One further drawback is that, with current technology, gasification and liquifaction processes are only 60 to 70% effective; thus 30 to 40% of the coal's original energy value is lost in the conversion process, an additional energy loss which must be added to that of the energy required to effect the conversion.

The conversion facilities are attempts to find solutions to problems with Illinois coal (primarily SO_2 emissions) at the consumption end. There are other problems associated with Illinois coal which arise at the extraction end of the coal industry. Illinois coal lies under agricultural land which is unquestionably ranked among the world's best. In short, extraction of Illinois coal leads to the question of coal or corn, fuel or food.

Some subsidence problems due to deep mines have occurred, but the major concerns stem from the increasing strip mine operations.

Since the first strip mine opened near Danville in 1866, more than 181,000 acres have been stripmined. 103,000 acres were stripped before Illinois's first, weak, reclamation legislation became effective in 1962. Most of this "abandoned" land has not be reclaimed; much of it remains in as poor condition as can be found anywhere.

The original reclamation law required a permit for operating a surface mine with an overburden of more than ten feet, and was administered by the Department of Conservation. In 1968, the law was amended to strengthen reclamation requirements.

The Surface-Mined Land Conservation and Reclamation Act of 1971, requires approval of a reclamation plan before a permit may be issued and stipulates that all mining reclamation must meet the requirements of the Illinois Environmental Protection Act. The law is administered by the Department of Mines and Minerals. It was amended in 1975 to allow more opportunity for local review of reclamation plans and to include more comprehensive requirements to improve restoration of the top layers of agriculturally productive soils. The effectiveness varies with the enforcement practices.

Virtually 100% of all land affected by strip mine operations since 1962 has been under permit. It has either been reclaimed or remains under bond pending reclamation. A company can be denied future permits for noncompliance with reclamation laws. The Land Reclamation Division of the Department of Mines and Minerals controls permits.

The Abandoned Mined Land Reclamation Council was established in 1975 to undertake special reclamation projects for lands mined prior to the 1962

surface mine reclamation laws. The council (seven department heads, chaired by the lieutenant governor) has designated three sites for reclamation projects.

Technological advances have now made it economically feasible to strip land in which the coal is 200 feet below the surface. Strip operations can extract nearly 100% of the coal in a seam; deep mines only about 55%. Approximately one-half the workforce needed for a deep mine is all that is needed to extract an equivalent amount of coal from a surface mine.

Illinois coal production from strip mines is expected to continue to increase despite rising concern as to its effect on agricultural productivity.

The first nuclear reactor in Illinois built to generate commercial electrical power becan operating at Dresden in 1960. Commonweath Edison now operates seven reactors at three generating stations. Eight more reactors (at four sites) are scheduled for completion during the early 1980's. As many as 1400 people may be added to the workforce when the plants go on line. Another station is planned, but contracts have not been let (See Figure 15).

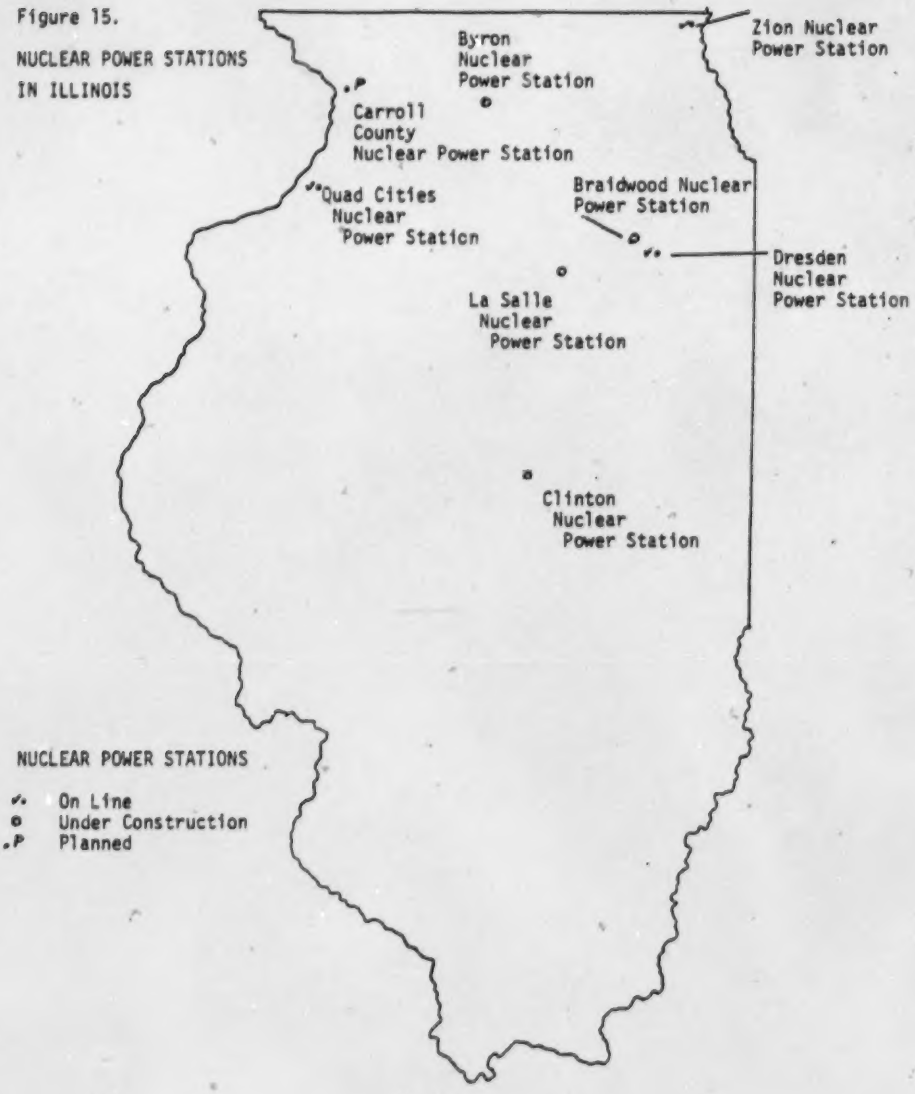
In 1975, 40% of the electricity generated by Commonwealth Edison (serving the Chicago and northern Illinois area) was generated from nuclear sources. This amounted to 25% of the electrical power generated in Illinois in 1975, and is far above the national average.

Energy is a pervasive, nebulous area. This is reflected by the numerous agencies, departments, and commissions throughout Illinois government whose responsibilities include matters which are energy related. There are three governmental entities whose primary responsibility is energy.

The Energy Coordinating Council, an executive council established under the Coal Development Act of 1974, was discussed above.

Figure 15.

NUCLEAR POWER STATIONS
IN ILLINOIS



The Division of Energy (DOE) is currently part of the Department of Business and Economic Development (BED). DOE began as the Office of the Fuel and Energy Coordinator during the energy crisis brought on by the Arab oil embargo. Fuel allocation was the original responsibility. As the governor added responsibilities the Office was given divisional status within BED. Its current staffing level is 27.

DOE activities are hampered because much of what it does is not based on any legislated mandate. This continues to cause difficulties as it tries to interact with other state government offices.

In addition to fuel allocation, DOE activities include:

1) Attempts to coordinate state in-house conservation efforts in building operations and maintenance;

2) Development of a state energy conservation plan as required under the federal Energy Policy and Conservation Act of 1975. (A feasibility report has been completed.);

3) Encouragement of alternative energy (especially solar) research and development;

4) Collection and analysis of data on supply and demand for all energy sources;

5) Provision of economic impact statements and economic reviews of coal development projects;

6) Monitoring and provision of analyses of federal energy legislation.

The Illinois Energy Resources Commission (IERC) is a legislative commission established in 1975. It has eight legislative and ten public members. The permanent staff of three has been temporarily expanded to eleven.

The commission is mandated to, "study, review and make recommendations on the administrative structure the state should adopt for the efficient management of the state's effort in finding solutions to energy-related problems."

The enabling act also stipulates the IERC shall:

1) Coordinate energy policy long-range programs;

2) Coordinate the agency structure;

3) Promote coal development projects (IERC has the authority for approval of all expenditures of Coal Development Bond funds);

4) Accept energy grants; and

5) Disseminate energy information.

The temporarily expanded staff has been heavily involved in planning for the future of Illinois' governmental organization for energy matters. The IERC staff has been developing draft legislation to be brought before the legislature in the spring of 1977. The legislation package includes:

1) Numerous amendments to the School Code to promote energy education and energy conservation in school facilities;

2) Amendments to the Board of High Education Act based on recommendations of the 1975 environmental/energy education and workforce study;

3) A home insulation and financing act;

4) An act prohibiting the use of certain decorative lighting gas lamps;

5) An energy efficiency labeling act;

6) Acts pertaining to solar rights and easements; and

7) A variety of other energy related acts which cover a broad spectrum.

The IERC staff has made a study of energy-related state governmental bodies. The findings and options for reorganization have been presented to the Commission in a booklet titled, "Illinois Energy Reorganization Options." In this publication problem areas of overlapping or conflicting jurisdiction in energy matters are identified and discussed and recommendations for improvement are made.

Four major options for reorganization of energy-related entities are presented in the booklet. Option I is the creation of a new state energy out of the existing Division of Energy, Department of Business and Economic Development. Option II is the creation of a Department of Natural Resources. It is similar to Option I, but would also consolidate existing energy and natural resources state bodies into one umbrella unit. Option III is the establishment of a small clearinghouse energy office, titled Central Energy Office. It would operate under the governor out of the Division of Energy to coordinate state action in relation to federal energy programs, especially grant programs. Option IV is the creation of an Energy, Environment and Natural Resources Commission. Rather than an executive energy agency as are the first three options, this would be an independent regulatory commission. Figures 16 through 19 illustrate the options.

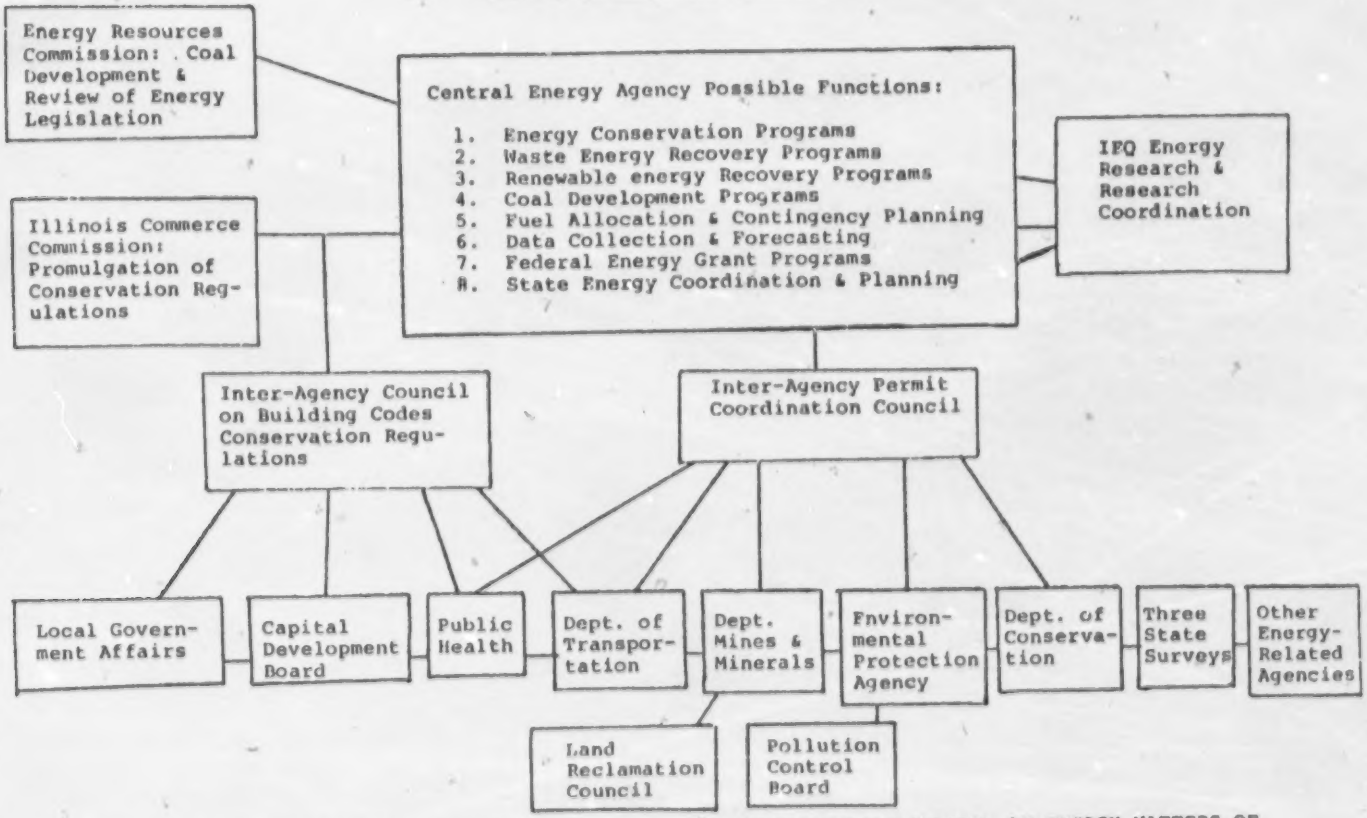
Portions of the four options may be recombined, thus creating further options. There is little indication at this time as to which, if any, of the above will be acted upon by the legislature. The future of state organization for energy matters remains uncertain.

Extensive research continues to be conducted in the state's public and private universities in energy conversion, energy conservation and in alternative energy technology.

Argonne National Laboratory (ANL) is one of the nation's largest federally funded research and development laboratories. The facilities are owned by the federal government; the University of Chicago operates the laboratories for the Energy Research and Development Administration (ERDA) under a tripartite contract among ERDA, the University of Chicago, and the Argonne Universities Association (a group of 30 midwestern universities).

OPTION 1*

Comprehensive Energy Act Agency


Energy Resources Commission: Coal Development & Review of Energy Legislation
Central Energy Agency Possible Functions:
1. Energy Conservation Programs
2. Waste Energy Recovery Programs
3. Renewable energy Recovery Programs
4. Coal Development Programs
5. Fuel Allocation & Contingency Planning
6. Data Collection & Forecasting
7. Federal Energy Grant Programs
8. State Energy Coordination & Planning
IEQ Energy Research & Research Coordination
Illinois Commerce Commission: Promulgation of Conservation Regulations
Inter-Agency Council on Building Codes Conservation Regulations
Inter-Agency Permit Coordination Council
Local Government Affairs
Capital Development Board
Public Health
Dept. of Transportation
Dept. Mines & Minerals
Environmental Protection Agency
Dept. of Conservation
Three State Surveys
Other Energy-Related Agencies
Land Reclamation Council
Pollution Control Board

ALL AGENCIES SUBJECT TO IN-HOUSE CONSERVATION PROGRAM, INFORMAL COORDINATION ON ENERGY MATTERS OF ENERGY AGENCY.

*Source: Illinois Energy Resources Commission

Figure 16

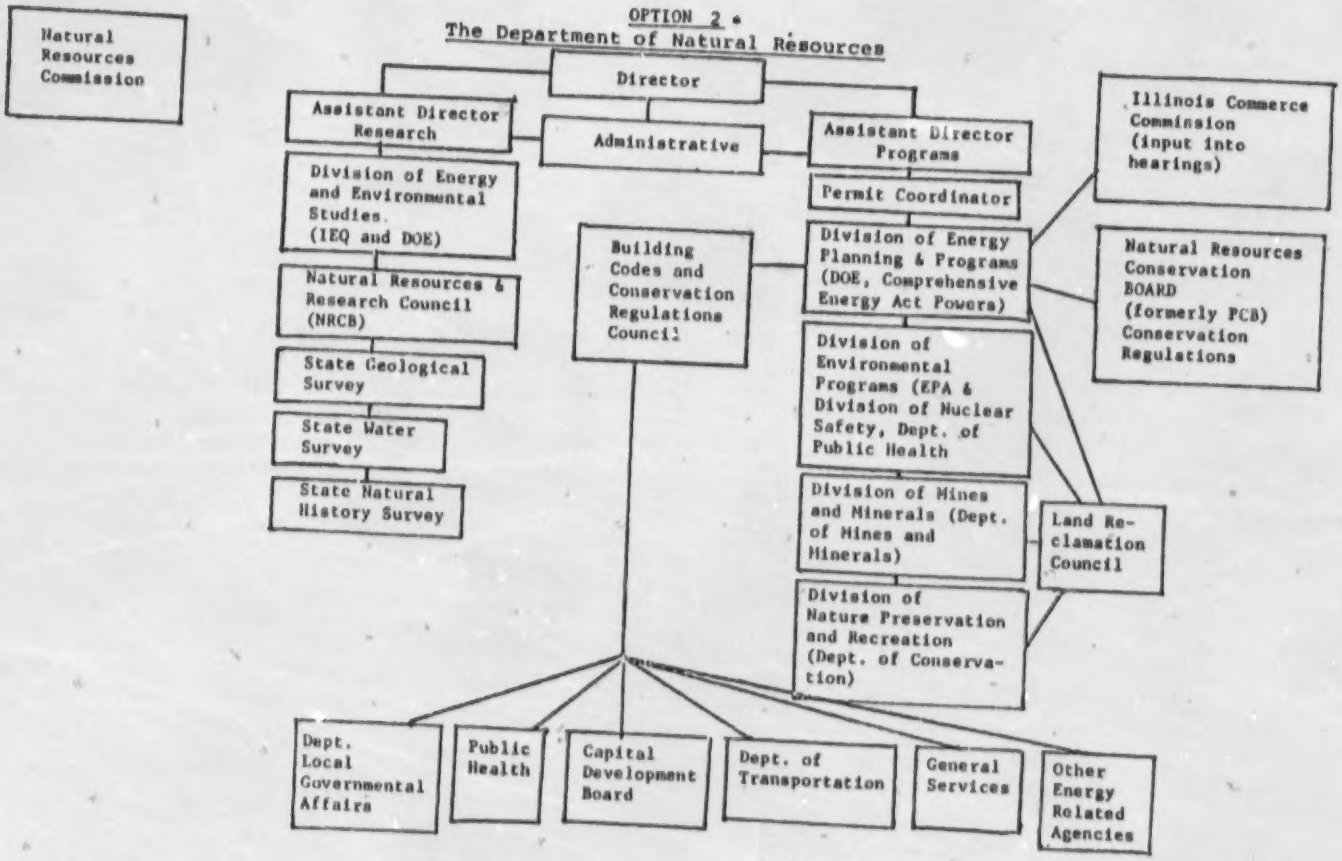
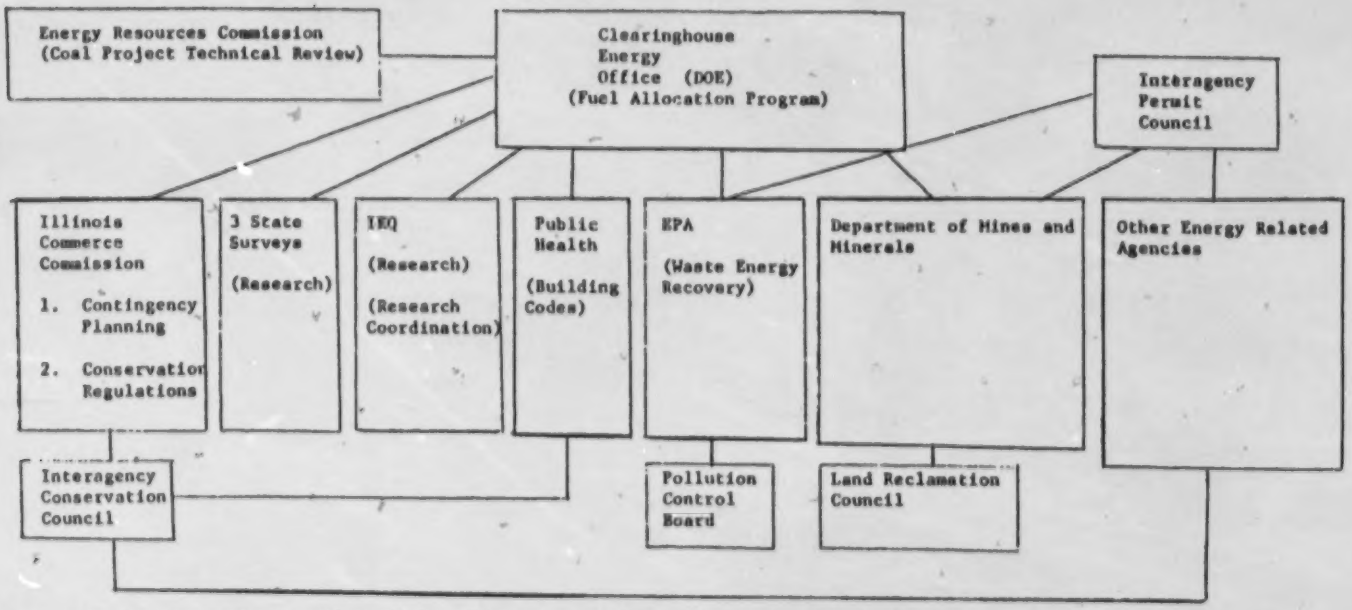

Natural Resources Commission
OPTION 2 *
The Department of Natural Resources
Director
Assistant Director Research
Administrative
Assistant Director Programs
Division of Energy and Environmental Studies. (IEQ and DOE)
Natural Resources & Research Council (NRCB)
State Geological Survey
State Water Survey
State Natural History Survey
Building Codes and Conservation Regulations Council
Permit Coordinator
Division of Energy Planning & Programs (DOE, Comprehensive Energy Act Powers)
Division of Environmental Programs (EPA & Division of Nuclear Safety, Dept. of Public Health
Division of Mines and Minerals (Dept. of Mines and Minerals)
Division of Nature Preservation and Recreation (Dept. of Conservation)
Illinois Commerce Commission (input into hearings)
Natural Resources Conservation BOARD (formerly PCB) Conservation Regulations
Land Reclamation Council
Dept. Local Governmental Affairs
Public Health
Capital Development Board
Dept. of Transportation
General Services
Other Energy Related Agencies

Figure 17

THE DEPARTMENT WOULD COORDINATE STATE IN-HOUSE CONSERVATION AND OTHER ENERGY-RELATED PROGRAMS.
*Source: Illinois Energy Resources Commission

OPTION 3 *



THE ENERGY OFFICE WOULD COORDINATE STATE ACTION ON FEDERAL ENERGY PROGRAMS AND PROJECTS, AND SERVE AS A CLEARINGHOUSE FOR ENERGY INFORMATION AND ACTIVITIES.

IT WOULD NOT ADMINISTER MAJOR ENERGY PROGRAMS.

*Source: Illinois Energy Resources Commission

Figure 18

OPTION 4*

Illinois Energy, Environment & Natural Resources Commission

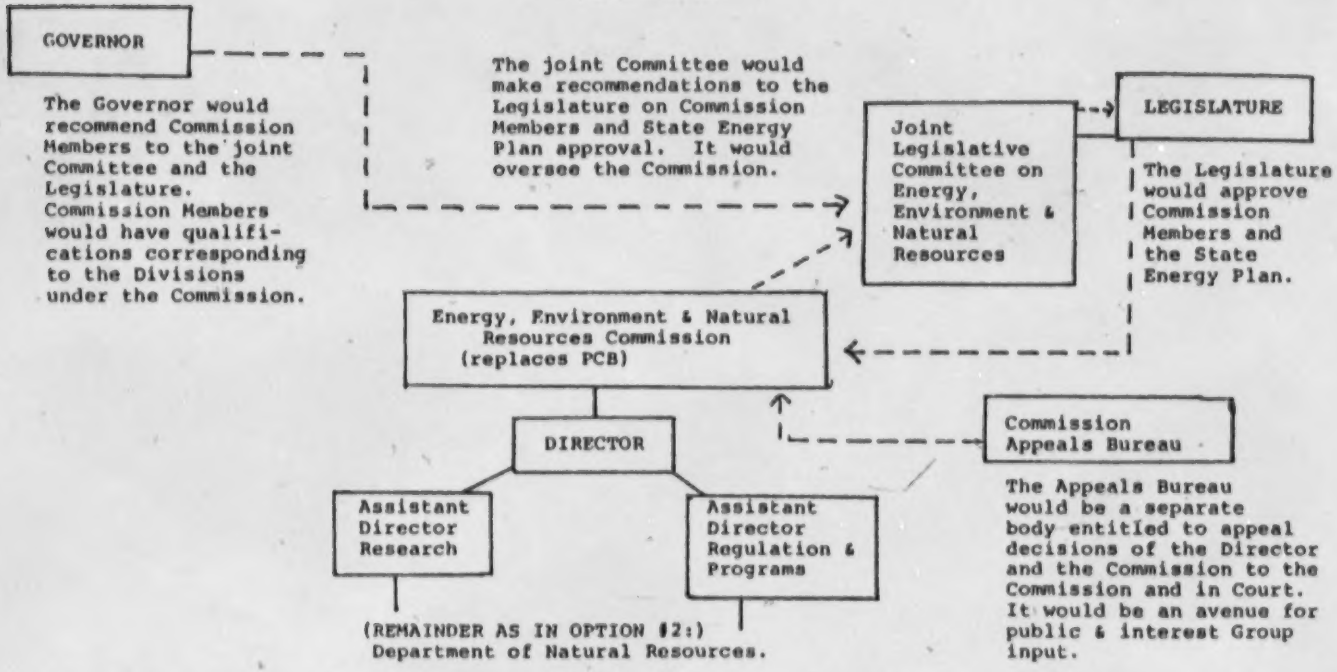

GOVERNOR
The Governor would recommend Commission Members to the joint Committee and the Legislature. Commission Members would have qualifications corresponding to the Divisions under the Commission.
The joint Committee would make recommendations to the Legislature on Commission Members and State Energy Plan approval. It would oversee the Commission.
Joint Legislative Committee on Energy, Environment & Natural Resources
LEGISLATURE
The Legislature would approve Commission Members and the State Energy Plan.
Energy, Environment & Natural Resources Commission (replaces PCB)
DIRECTOR
Commission Appeals Bureau
The Appeals Bureau would be a separate body entitled to appeal decisions of the Director and the Commission to the Commission and in Court. It would be an avenue for public & interest Group input.
Assistant Director Research
Assistant Director Regulation & Programs
(REMAINDER AS IN OPTION #2:) Department of Natural Resources.

Figure 19

1. The Commission would set final policy decisions, adopt regulations and hear cases arising under regulations. The Pollution Control Board would be abolished.
2. The Director would be appointed by the Commission or be a Commission Member.
3. The Commission would prepare a State Energy Plan for adoption by the Legislature.

*Source: Illinois Energy Resources Commission

Most Argonne activities are funded by ERDA, but many projects are supported by local, state and other federal agencies. The operating budget for FY 1976 was nearly $148 million.

Argonne is located on a wooded 1,700 acre site, 27 miles southwest of downtown Chicago. It began as the Metallurgical Laboratory at the University of Chicago, established in early 1942, as a part of the Manhattan Project. Later that year, Enrico Fermi directed the experiment that led to the first controlled nuclear chain reaction.

With the succession of ERDA and its assumption of authority formerly relegated to the Atmoic Energy Commission, Argonne has had an expanding role in energy research. Much of ANL's reactor research, including work on the liquid metal fast breeder reactor (LMFBR) is conducted at Argonne-West in Idaho.

Argonne energy research and development activities include high performance battery testing, magnetohydrodynamic (MHD) generator research, experiments with solar energy devices, and an extensive coal technology program. Energy conservation, storage, and conversion studies are being conducted as are studies of the impacts of energy-related pollutants on man and ecosystems. Technologies for controlling such pollution are being developed and tested.

ANL's Energy and Environmental Systems Division (EES) is an interdisciplinary team of engineers and natural and social scientists. It specializes in mission-oriented applied research, systems analysis and policy evaluation.

The Division's activities include:

1) Atmospheric Science;

2) Coal Extraction and Land Reclamation;

3) Energy conservation;

4) Energy and Environmental Technology;

5) Regulatory Studies;

6) Resource Management;

7) Systems Analysis, Technology Assessment and Policy Evaluation;

8) Water Resources.

B. Workforce Profile

Data for this and other sections were gathered through on-site interviews. Of particular assistance were Mr. Sheridan Glen, Mr. J. Ernest Dunwoody, and Mr. Bruce Green, of the Division of Energy; Mr. Donald Handy, of the Illinois Energy Resources Commission; Mr. J. D. Grady, Manager, Westinghouse Training Center, Zion, Illinois. Several people at Argonne National Laboratory, Mr. Art Vervack, Ms. Pat Failla, Mr. Tom Baldwin, and Dr. Shelby Miller among them, were most helpful as were numerous others in a variety of capacities.

The Division of Energy currently employs 27 persons, seven of whom are in clerical positions. Staffing at DOE is fluid. At the present, there are three persons involved in fuel allocation, two in coal development, three in program development, and twelve (four of them contractual) in energy conservation and alternative energy.

The Illinois Energy Resource Commission temporary staffing level of eleven includes the director, five clerical people, a loaned executive from NASA to work and advise on the engineering and technical aspects of the Commission's effots, an economist and a consultant to draft proposed energy legislation, a staff attorney under a contractual arrangement, and an individual to coordinate the Commission's Study Panel's activities and reports.

The Land Reclamation Division of the Department of Mines and Minerals employs eight technical persons educated in agronomy, engineering, chemistry, and related areas. This staffing represents a ratio of about one person for every 20 mining companies in Illinois. Although the workload is heavy, the staffing level is considered adequate, at present.

The Abandoned Mine Land Reclamation Council has a three-person staff.

There are no estimates as to the size of the private sector workforce in energy as it relates to pollution control and abatement. People in the field are reluctant even to surmise as to numbers in reasonably specific categories. Much of the work in this diverse area is but one part of an individual's overall duties and is not easily identifiable in terms of number of people or manhours.

Of the 4,425 Argonne National Laboratory employees, about 1,500 have college degrees, nearly half of them Ph.D.s. Another 380 are technicians. The Energy and Environmental Systems Division (EES) is the fastest growing section of ANL. Currently, there are eighty professionals in EES with degrees in 39 different professional areas including such diverse areas as aerospace engineering, demography, geophysics, mechanical engineering, oceanography, environmental studies, sociology, and urban planning.

There are 60-80 persons employed in radiation control in the nuclear power plants. Public sector workforce staffing for the radiation control portion of the nuclear energy industry are discussed in RADIATION.

Due to increasingly explicit legislation in surface mine reclamation, mining operations have increased the time and number of persons involved in

reclamation activities, but there are no available estimates as to how many are so employed.

In October, 1976, DOE published a directory of solar energy-related equipment manufacturers, architects and engineers. Ten Illinois equipment manufacturers and distributors are listed; 18 architects, engineering companies and solar energy consultants are listed. DOE personnel say the publication needs updating; they are sure many companies were missed.

Three publications have listed projects and personnel conducting energy research at the universities in Illinois.

C. Workforce Projections

The future of the public sector workforce in energy is uncertain. If any of the Illinois Energy Resource Commission (IERC) staff options (or a combination, thereof) for the reorganization of energy-related entities in Illinois government are adopted, significant changes in responsibilities and staffing levels could occur as a result of realignment.

Most likely to be affected under any change will be the Division of Energy (DOE). DOE has experienced rapid growth, especially in the Energy Conservation and Alternative Energy Section. Growth in this area is expected to continue. However, due to the uncertainty resulting from conflicting rumors of reorganization there is an understandable reluctance to discuss specific numbers and direction of thrust.

Regardless of the nature of reorganization, there will be a significant increase in the positions with responsibilities in energy conservation and alternative energy in Illinois. What is not known is to which governmental body they will be assigned.

The Illinois Energy Resources Commission staff will be reduced to the director, two secretaries and a technical person at the end of FY 1977. IERC staff has recommended a narrowed mandate for the Commission. Staffing for IERC may fluctuate over the next few years as new responsibilities are added and as updating of IERC materials and efforts are required.

Overall, the public sector workforce is expected to increase as the nation and the state become increasingly energy-conscious. Specific assignment of energy responsibilities and positions as to governmental organization remains uncertain in Illinois.

Workforce projections for the private sector are unavailable. Field sources are certain of substantial growth in research activities, development and dissemination of alternative energy technology (especially solar), mining reclamation, coal development-related pollution control techniques, and energy conservation. Expansion in these areas is well underway and is expected to accelerate rapidly in the next few years.

Argonne National Laboratory anticipates an annual growth rate of about 4 per cent over the next five years. There are no estimates for private sector activities.

D. Training and Certification

In addition to the extensive education and research activities relavant to energy conducted at the public and private universities in Illinois, there are three special facilities which engage in energy-related research and education.

Argonne National Laboratory has a major commitment to education and training programs in conjunction with universities and other schools. Such activities fall into five categories:

1) Research Participation. University students, faculty and post-doctorates usually participate in one research problem under supervision of an ANL scientist or engineer. The research experience may last from eight weeks to one year or as long as three years for thesis students or post-doctorates;

2) Internships. High school and university students may participate in several assignments shorter than those of the first category. The assignments often involve experience other than research;

3) Workshops. Most workshops average about two days, but may last a week. They are usually for university faculty, but may be presented for ERDA or industrial personnel. Workshops often include laboratory exercises or simulated on-the-job experience as well as lectures;

4) Institutes and Courses. These are one to six week learning sessions for faculty or ERDA and other research and development facility personnel. The tutorial experience is reinforced with field observations, demonstrations, or experiments;

5) Conferences. ANL personnel, faculty and graduate students participate in a tutorial experience for two to four days. Conferences often involve visits to ANL project organizations.

In addition to the above, ANL hires temporary employees, often faculty, graduate or undergraduate students, and post-doctorals, who, although they contribute to a research project, also find it to be a learning experience.

Fermilab, at Batavia, Illinois, is a high-energy physics research facility. It has educational and training experience programs for university faculty and students similar to that of Argonne.

The Westinghouse Electric Corporation, Nuclear Service Division, operates a major training facility for nuclear reactor power plant operators at Zion, Illinois. The Westinghouse Training Center, which employs 29 persons, is operated under a joint venture agreement with Commonwealth Edison.

In addition to classroom instruction, trainees operate the simulator (a duplicate of the control room of the Zion nuclear power plant), and train on the Westinghouse Nuclear Training Reactor.

The programs are designed to meet Nuclear Regulatory Commission (NRC) requirements for training of nuclear power plant personnel, including preparation for the Senior Reactor Operator (SRO) and Reactor Operator (RO) licensing.

Training is conducted under a contractual agreement between Westinghouse and utilities with nuclear power plants.

The operator training program consists of three phases: Phase I (11 weeks) includes eight weeks of classroom instruction and three weeks training on the small nuclear training reactor. Phase II (10 weeks) consists of systems training; and Phase III (9 weeks) is training on the simulator.

Under NRC regulations persons must meet certain requalifying requirements every two years to retain an operator's license. Westinghouse has developed and conducts courses which meet these requirements.

Of the twenty-four instructors at the Center, twenty have experience in the U.S. Navy nuclear program. Some state personnel, however, have expressed the opinion that there is an overemphasis on nuclear expertise.

The U.S. Bureau of Mines is establishing a mining research station at a cost of $1.875 million to be located at Carbondale. The station will be the fifth of its kind and the first to be established since the 1950's. It will employ approximately 50 scientists, engineers, and technicians.

Extensive cooperation is planned between the station and the University of Southern Illinois-Carbondale Coal Extraction and Utilization Research Center. The Illinois Board of Higher Education has recommended program support

of $150,000 to the center for FY 1978 and $50,000 support for an M.S. in mining engineering program for the same period. However, this funding level may be cut substantially.

E. Career Potential

Career opportunities are expanding now and are expected to continue to increase for several years. Engineers with training in both fluids and thermal will be in special demand. Other engineers, scientists, architects, and social scientists with flexible training capabilities will be needed as changes in our energy system are researched, designed, built, and effect changes in society.

There may well be opportunities for draftsmen and other skilled trades as alternative energy systems are becoming more economically competitive.

The opening of new coal mines, especially strip mines, and the increasingly strict mine reclamation legislation and concern over the loss of agricultural land will precipitate an increase in demand for people with the variety of skills needed for comprehensive reclamation work.

The commitment to development of Illinois coal and the continued commitment to nuclear power in Illinois will insure opportunities for persons with skills appropriate to each of these areas.

F. Conclusion

The public sector workforce is expected to increase in Illinois over the next five years as energy research, planning, conservation, and public education activities expand. There will be positions for engineers, planners, systems analysts, administrators and social scientists.

Illinois' commitment to coal development and nuclear power will continue to keep these areas open to increased employment.

Momentum is increasing in research and development activities in alternative energy sources. Employment opportunities for persons with a broad variety of skills will continue to improve as alternative energy systems become more economically competitive.

Although specific projections cannot be made at the present time, it is anticipated that persons with combined training in fluid and thermal engineering will be in demand. Specific skills which are projected to be in demand over the next few years include the following: 1) basic knowledge of technological skills; 2) managerial and organizational skills; and, 3) public relations skills. Persons with education and skills which can be interfaced with energy in the development and implementation of changes in energy systems, energy policy, and the effects on society will be sought.

Selected Post Secondary Institutions With Formal Environmental Energy Programs

In 1974-75, the Illinois Institute for Environmental Quality and the Illinois Board of Higher Education pooled resources to develop a "Master Plan for Environmental/Energy Higher Education in Illinois". The U.S. Environmental Protection Agency joined in the effort and provided funds to add a workforce study and related curricula recommendations component to the project.

On-site interviews were conducted at twelve of the thirteen state universities. Telephone interviews and extensive correspondence were conducted with private colleges and universities and public community colleges. Personal and telephone interviews were held with numerous persons in the public and private sectors of pollution control activities. Results of the interviews and recommendations for changes in and additions to environmental/energy educational efforts were compiled and published in May, 1975, under the title, "A Work Force for Environment and Energy."

The book includes:

1) Detailed descriptions of ongoing environmental and energy programs at state universities in Illinois;

2) Descriptions of proposed environmental and energy programs at state universities in Illinois;

3) Recommendations for Illinois Board of Higher Education approval of proposed environmental and energy programs;

4) Brief descriptions of environmental and energy educational programs offered in private universities and colleges in Illinois;

5) Synopses of programs and course offerings at Illinois community colleges;

6) Recommendation for initiating and implementing environmental/ energy operating plans for the campus of each public university and college in Illinois;

7) Recommendation for establishing Environmental Resource Centers at community colleges;

8) Suggested curricula for Illinois community college degree and certificate programs;

9) Manpower study of pollution control fields in Illinois;

10) A variety of recommendations and reference materials to enhance cooperation among institutions of higher education in Illinois in environmental and every related matters.

Nearly two years have elapsed since the Illinois Board of Higher Education (IBHE) formally acknowledged receipt of the "Master Plan for Environmental/Energy Education in Illinois." The plan has largely been ignored as environmental education has been accorded little emphasis and energy education is only now beginning to assume importance. Some program recommendations in the plan have been acted upon as evidenced by the following program support funding recommendations by the Illinois Board of Higher Education staff for FY 1978:

1) Eastern Illinois University B.S. in Business, Major in Energy Management	$ 30,000
2) Southern Illinois University-Carbondale M.S. in Mining Engineering	50,000
Coal Extraction and Utilization Research Center	150,000
3) Southern Illinois University-Edwardsville M.S. in Environmental Studies	50,000
4) University of Illinois-Urbana-Champaign Institute for Environmental Studies	24,000
TOTAL	$304,000

It should be noted that this is the recommended funding level. Actual funding may be no more than 50% of that recommended. These proposed programs were already under review by IBHE staff before the environmental/energy master plan study was begun. It is likely these programs would have been funded even had there been no master plan. Other recommendations regarding ongoing or proposed programs included in the master plan have not been acted upon.

None of the recommendations for non-curricular environmental/energy education activities (specifically the campus environmental/energy operating plans for environmental quality improvement and energy conservation, and the community college Environmental Resource Centers, have even been considered by IBHE.

The Illinois Energy Resources Commission, (IERC), is currently drafting energy-related legislation. Although several bills include components derived from recommendations in the IBHE Environmental/Energy Master Plan, little cooperation between IBHE and IERC staff has transpired.

SENIOR INSTITUTIONS

The Illinois Institute of Technology
Chicago, Illinois

Program: Environmental Engineering (B.S., M.S., Ph.D.)

Hours required for major: Not Available
Program Inception: 1964
Staff Size: Nine (8 Ph.D.s); six teaching assistantships; and fifteen research assistantships
Enrollment: 58 masters level students; 12 Ph.D. candidates; 25 undergraduate
Graduates (1976): 18
Placement: 100%
Graduate Work: 70

Courses - Selected

(Undergraduate)

Introduction to Water Resources Engineering
Fundamentals of Water and Wastewater Treatment
Sanitary Engineering Design
Chemistry of Environmental Systems
Introduction to Air Pollution Control
Solid Waste Engineering

(Graduate)

Environmental Chemistry
Water and Wastewater Analysis
Principles of Water Chemistry
Man and His Environment
Ecology of Aquatic Systems
Biochemical Engineering
River Ecology
Eutrophication
Ecological Engineering and Systems Ecology
Environmental and Urban Systems Analysis
Systems Analysis of Water Resources and Water Quality
Physical Processes of Water and Waste Treatment
Chemical Processes of Water and Waste Treatment
Design of Sanitary Engineering Processes
Industrial Waste Treatment
Air Pollution Meteorology
Air Pollution Instrumentation and Analysis
Ambient Air Monitoring
Air Pollution Engineering
Stack Sampling and Analysis
Atmospheric Chemistry
Design of Air Pollution Control Devices

SENIOR INSTITUTIONS

Sangamon State University
Springfield, Illinois

Program: Environments and People (B.A., M.A.)

Hours required for major: Semester - (B.A.) 28, (M.A.) 32
Program Inception: 1970
Staff Size: Five (three Ph.D.s); two or three adjunct instructors each year; and two graduate assistantships.
Enrollment: 59
Graduates: 13
Placement: Over 50%

Courses - Selected

The Population Controversy
Issues in Population: Policy and Action
Wildlife Resources
People's Energy Needs
Water Resources
Biology of Water Pollution
Land and Resources Use: Environmental Analysis, Policy, and Planning
Land-Use Planning: Principles and Practices
Heredity, Evolution, and Society
Ecology and Society: Implications for Public Institutions
Ecology and People
Sociology of Natural Resources
Geography-Life Geosystems
Environmental Climatology
The Historical Geography of the United States
Midwest Rural Life and its European Background
Midwest Rural Life and its American Regional Background
Environmental History, A Problems Approach
Environmental Perception
Energy and the Environment
Environmental Policies
Citizen Action in Environmental Affairs
Environmental Law and the Citizen
Environmental Law and Illinois Government

State Legislation

TITLE:

Environmental Protection Act
Illinois Statutes 111½

PURPOSE:

To establish a unified, state-wide program to restore, protect and enhance the quality of the environment, and to assure that adverse effects upon the environment are fully considered and borne out by those who cause them.

DEFINITIONS:

1. Agency
2. Air pollution
3. Board
4. Contaminant
5. Garbage
6. Institute
7. Open burning
8. Open dumping
9. Person
10. Public water supply
11. Refuse
12. Sanitary landfill
13. Sewage works
14. Water pollution
15. Waters
16. Municipality

ADMINISTERING AUTHORITY:

Environmental Protection Agency
Pollution Control Board

AUTHORIZATIONS:

To conduct surveillance and inspection of various pollution sources;
To enter and inspect property in enforcement of the act;
To generally enforce the act;
To issue regulations pursuant to the act;
To administer funds and act as the state lead agency in air, water, public water, noise and solid waste areas;
To administer permit programs pursuant to the act;

AUTHORIZATIONS (Cont'd):

To establish ambient air quality and emission standards;
To control potential sources of air pollution contamination;
To establish water quality and effluent limitation standards;
To control water pollution sources;
To approve construction and operation of all public water supplies;
To establish construction and sanitation standards for refuse disposal sites;
To control refuse dumping;
To regulate noise emissions and sources;
To issue permits for nuclear power facility construction.

PROHIBITED ACTS:

To allow or cause air pollution;
To operate or construct potential air pollution sources without permit;
To cause or allow open burning of refuse;
To cause air pollution from asbestos fibers;
To allow or cause water pollution;
To operate or construct water pollution sources without permit;
To violate the terms of any permit;
To fail to provide clean, safe water supplies;
To cause or allow open dumping of refuse;
To abandon any vehicle;
To conduct refuse collection or disposal without permit;
To dispose of refuse except at a solid waste facility;
To emit unreasonable levels of noise;
To violate any regulation or provision of the act.

EXEMPTIONS:

Regulations may make different provisions depending on circumstances, sources and geographical area.

PENALTIES:

General violation - fines of up to $10,000 and $1,000 per day;
Water permit violations - fines of up to $10,000 per day;
Liability imposed for damage to fish and wildlife;
Criminal penalties for water pollution violations - fines of up to $25,000 plus a misdemeanor.

ILLINOIS PESTICIDES

TITLE:

Custom Application of Pesticides Act
Illinois Statutes 5-87

PURPOSE:

To provide for the control of pesticide usage and the licensing of pesticide application activities.

DEFINITIONS:

1. Aircraft
2. Custom application of pesticides
3. Director
4. Fungicide
5. Fungus
6. Ground equipment
7. Herbicide
8. Insect
9. Insecticide
10. Nematocide
11. Nematode
12. Person
13. Pesticide applicator
14. Pesticide operator
15. Pesticides
16. Public application of pesticides
17. Public applicator
18. Public operator
19. Structure
20. Weed

ADMINISTERING AUTHORITY:

Department of Agriculture
Interagency Committee on Pesticides

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To classify pesticides and restrict their usage;
To enter and inspect in enforcement of the act;
To establish certification standards and certify commercial applicators;
To generally enforce the act.

CERTIFICATION OR LICENSING:

Restricted users must be certified in operator or applicator category; examination and showing of knowledge required.

PROHIBITED ACTS:

To engage in custom application without certification;
To violate other regulations or act provisions.

EXEMPTIONS:

Structural pest operators, governmental units, fumigators, farmers of limited application, tree experts, veterinarians, canning establishments, and general pest control operators.

PENALTIES:

First offense - fines of up to $200;
Subsequent offenses - fines of up to $400.

ILLINOIS POTABLE WATER

TITLE:

Water Supply Operator Certification Law
Illinois Statutes 111½-501

PURPOSE:

To safeguard the health of the people and control the public water supplies of the state.

DEFINITIONS:

1. Water supply operator
2. Public water supply
3. Agency
4. Director
5. Advisory board
6. Owner or operator

ADMINISTERING AUTHORITY:

Environmental Protection Agency
Water Supply Operators' Advisory Board

AUTHORIZATIONS:

To establish water supply operator certification standards;
To certify water supply operators;
To enforce the act.

CERTIFICATION OR LICENSING:

Water supply operators must be certified according to four classifications; qualifications set forth and examination is required.
Provision made for prior operators and other certificate holders.

PROHIBITED ACTS:

To operate a public water supply without certified operator;
To violate terms of a certificate

PENALTIES:

Fines of from $100 to $1,000.

ILLINOIS RADIATION

TITLE:

Radiation Installation Registration Law
Illinois Statutes 194

PURPOSE:

To provide for the control and registration of all radiation installations in the state.

DEFINITIONS:

1. Radiation
2. Radiation machine
3. Radioactive material
4. Radiation installation
5. Operator
6. Sealed source
7. Department
8. Director
9. National Committee on Radiation Protection

ADMINISTERING AUTHORITY:

Department of Public Health

AUTHORIZATIONS:

To require registration of all radiation installations;
To inspect and investigate installations to enforce the act.

PROHIBITED ACTS:

To fail to register radiation installation as required;
To violate any act provisions.

EXEMPTIONS:

Low-level, non-harmful or some natural radioactive sources.

PENALTIES:

Violation constitutes misdemeanor.

ILLINOIS RADIATION

TITLE:

Radiation Protection Act
Illinois Statutes 211

PURPOSE:

To provide for the effective regulation of radiation sources and to permit maximum utilization of sources of ionizing radiation.

DEFINITIONS:

1. By-product material
2. Department
3. Director
4. General license
5. Person
6. Radiation
7. Radiation installation
8. Radiation machine
9. Radioactive material
10. Radiation source
11. Source material
12. Special nuclear material
13. Specific license

ADMINISTERING AUTHORITY:

Department of Public Health
Radiation Protection Advisory Council

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To license by-product, source and special nuclear materials;
To register other radiation sources;
To enter into agreements with state and federal agencies;
To develop a comprehensive radiation control program;
To require radiation exposure records;
To issue abatement orders.

PROHIBITED ACTS:

To intentionally administer radiation to human being;
To violate the terms of any license;
To violate any provision or fail to perform any duty under the act.

EXEMPTIONS:

Physicians, dentists, and chiropractors.

PENALTIES:

Violation constitutes misdemeanor.

NRC AGREEMENT STATE: No